

Epidemiology of FUNCTIONAL DISTURBANCES AND DISEASES IN THE STOMATOGNATHIC SYSTEM

A cross-sectional study of 7–18 year olds
from an urban district

by

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PREFACE

This thesis is based on the following papers, which will be referred to by their Roman numerals:

- I. Nilner, M. & Lassing, S-Å. Prevalence of functional disturbances and diseases of the stomatognathic system in 7 - 14 year olds. Swed. Dent. J. 1981, 5, 173-187
- II. Nilner, M. Prevalence of functional disturbances and diseases of the stomatognathic system in 15 - 18 year olds. Swed. Dent. J. 1981, 5, 189-197
- III. Nilner, M. Relationships between oral parafunctions and functional disturbances and diseases of the stomatognathic system among children aged 7 - 14. Acta Odontol. Scand. In press
- IV. Nilner, M. Relationships between oral parafunctions and functional disturbances and diseases in the stomatognathic system among 15 - 18 year olds. Acta Odontol. Scand. In press
- V. Nilner, M. & Kopp, S. Distribution by age and sex of functional disturbances and diseases of the stomatognathic system in 7 - 18 year olds. Swed. Dent. J. In press

DEFINITIONS

Functional disturbances and diseases of the stomatognathic system:

- The occurrence of the following symptoms:
pain in the temple region, pain when opening the mouth wide, difficulties when opening the mouth wide, pain or difficulties when chewing and temporomandibular joint sounds.
- The occurrence of the following signs:
tenderness to palpation of the temporomandibular (TMJ) and TMJ-muscles, pain on passive opening, impaired mobility when opening wide, clickings, irregular mandibular movements, deviations at opening wide and/or protrusion and asymmetrical lateral mobility.

Recurrent headaches:

- Headaches which occur more than once a week which do not have any other medical reason.

Interferences in the retruded position (RP):

- Single- and double-sided contacts in the terminal hinge movement, when a vertical difference between the retruded contact position (RP) and the intercuspidal position (IP) was observed by the naked eye.

Mediotrusion interferences:

- Interferences on the mediotrusion side were recorded when the contact surfaces on the antagonizing teeth were visible as shining facets. The interferences were recorded during any stage of lateral movement.

Tenderness to palpation of the TMJ and TMJ-muscles:

- Pain to palpation was recorded when the individual reported tenderness on the palpation.



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INTRODUCTION

Since the beginning of the eighth decade there has been a great interest in epidemiology concerning functional disturbances and diseases of the stomatognathic system (for a review see Helkimo, 1979). Many studies have reported a high prevalence of symptoms and signs from the stomatognathic system. It has been concluded that more than 50% of the adult Swedish population have such symptoms and signs. Although the reported prevalence of symptoms and signs have been high (70-80%), the need for treatment have been suggested to be about 25% (Hansson & Nilner, 1975). Nearly all epidemiologic studies have dealt with adults and first lately there have been a growing interest in children and adolescents (Grosfeld & Czarnecka 1977, Nilner & Lassing 1981, Nilner 1981 and Egermark-Eriksson 1982).

One early publication concerning children and "diseases due to loading in the masticatory system" is that of Seyffarth & Steen-Johnsen (1956), they examined 264 individuals of the age of 8 - 14. The examination included inspection and palpation and was carried out in co-operation with a physiotherapist. The inspection comprised head- and bodyposition, facial expression, speech, occlusion, breathing, and the palpation included the temporomandibular joint (TMJ), TMJ-muscles, neck- and back-muscles. Symptoms and signs of "diseases due to loading" were found in 54% of the subjects.

Geering-Gaerny & Rakosi (1971) examined 241 children aged 8 - 14. They asked the subjects about sucking habits, mouth-breathing, trauma to the head and the state of the general health. Their clinical examination included assessment of malocclusion, lip-biting, tongue-thrusting, palpation of the TMJ and TMJ-muscles as well as auscultation of TMJ-sounds and measurement of mandibular movements.

Fourty-one per cent of the children showed one or more of the following symptoms, pain on palpation of the joints and musculature, joint noises such as grating or clicking, deviation of the mandible on mouth opening. However, no child complained of pain.

In a study by Siebert (1975) two groups of children, 12 - 16 years of age, were examined. One group consisted of 98 individuals who were going to be treated orthodontically and the other group of 114 individuals who had been treated orthodontically. TMJ-muscle tenderness was found in 80% of the untreated children and in 60% of the orthodontically treated children. No figures of the frequency of symptoms were reported.

An epidemiologic study of 500 children from Warsaw's primary school - 250 children aged 6 - 8 years and 250 aged 13 - 15 years, showed a prevalence of "musculo-articular disorders of the stomatognathic system" of 56.4% and 67.6%, respectively (Grosfeld & Czarnecka 1977). The prevalence and severity of symptoms and signs were significantly higher in the 13 - 15 year age group than in the younger age group. A statistically significant ($p < 0.05$) relationship between malocclusion and "disorders" was found in the older age group.

Dibbets (1977) made a longitudinal study of 112 children (mean age 12.5 years) with malocclusion, Angle class II division 1. He found that 46% had or developed symptoms or signs of functional disturbances and diseases of the stomatognathic system and of these 24% were diagnosed by TMJ radiography to have an "Arthrosis Deformans Juvenilis (ADJ)". Symptoms such as pain, clickings or snapping emanating from the joint or restricted mobility were reported in 12%.

The symptoms and signs per se did not seem to affect the growth of the mandible, but the children with ADJ and trauma developed a "distinctive mandibular growth pattern".

In 304 children between 6 and 16 years of age (with a mean of 12.9) an investigation was made to analyze the percentage of "potential temporomandibular dysfunctional patients" prior to orthodontic treatment (Williamsson 1977). Of the children, 35.2% were found to have pain on palpation of the TMJ-muscles, clickings or both. Of the TMJ-muscles palpated, the lateral pterygoid was the most frequently tender muscle, the medial pterygoid being the second and the masseter the third. Clickings were noted in 19%. The author concluded that there seems to be a strong predisposition for "temporomandibular dysfunction" in the subjects with Angle class II division 2 or deep bite with Angle class I.

Wigdorowicz-Makoweroea, Grodzki, Parrek, Mąslanka, Plonka & Palacha (1979) have studied 2100 children 10 to 15 years of age in an epidemiologic study, where they reported a prevalence of "TMJ-dysfunctions" of 40.4% in subjects with bruxism and 26.9% without bruxism.

Egermark-Eriksson, Carlsson & Ingervall (1981) have presented an epidemiologic study of 402 children in three age groups, 7 years, 11 years and 15 years. The children responded to a questionnaire and were examined clinically. Symptoms consisting of TMJ-sounds, tiredness in the jaw and face, difficulties in opening the mouth wide were reported to occur in 16, 17 and 25%, but when pain or tiredness in the jaws or face during chewing were included the frequency increased to 39, 67 and 74%. The prevalence of clinical signs of dysfunction according to the index of Helkimo (1974a) increased with age from about 30% in the youngest to

60% in the oldest age group.

The studies mentioned (Table 1) show that functional disturbances and diseases of the stomatognathic system not only exist among children and adolescents, but that the prevalence is higher than assumed hitherto. The prevalence of signs and symptoms also seem to vary demographically like those of most other diseases. Important factors which explain part of the marked differences in prevalence figures reported are differences in definitions and examination techniques.

This study was undertaken to further elucidate the prevalence of oral parafunctions and symptoms and signs of functional disturbances and diseases in the stomatognathic system in children and adolescents, to achieve further knowledge of etiology and to shed light on the need of treatment in different age groups.

Table 1. Prevalence of symptoms and signs of functional disturbances and diseases of the stomatognathic system, age and sex composition of the investigated populations in some epidemiologic studies and studies of epidemiologic character. * Including pain or tiredness in the jaws or face during chewing.

Authors	Number of individuals	Number of females/males	Age year	Prevalence of: Symptoms	Signs
Seyffart & Steen-Johnsen (1956)	264	-	8-14	-	54%
Geering-Gaermy & Rakosi (1971)	241	-	8-14	-	41%
Siebert (1975)	212	124/88	12-16	-	62-80%
Grosfeld & Czarnecka (1977)	250 250	136/114 133/177	6-8 13-15	- -	56% 68%
Dibbets (1977)	112	63/49	8-17	-	46% (symptoms + signs)
Williamsson (1977)	304	175/129	6-16	-	35%
Wigdorowicz-Makowerowa et al. (1977)	2100	-	10-15	-	40% (with bruxism) 27% (without bruxism)
Egermark-Eriksson, Carlsson & Ingervall (1981)	136	74/62	7	16% 39%*	33%
	131	61/70	11	17% 67%*	46%
	135	59/76	15	25% 74%*	61%

AIMS OF INVESTIGATION

1. To estimate the prevalence of symptoms and signs of functional disturbances and diseases of the stomatognathic system in children and adolescents aged 7-18 in Malmö.
2. To investigate the relationships between symptoms, signs, oral parafunctions, occlusal interferences and malocclusions in these age groups and thereby to evaluate etiological factors of functional disturbances and diseases in the stomatognathic system in these age groups.
3. To study oral parafunctions, symptoms and signs of disturbances and diseases in the stomatognathic system of children and adolescents in relation to sex and age.

SUBJECTS AND METHODS

SUBJECTS

Totally 749 randomly selected children and adolescents were examined. They were in paper I - IV divided into two groups namely 440 children aged 7-14 and 309 adolescents aged 15-18. The age and sex distribution is seen in Table 2.

Table 2. Distribution of the 749 examined children and adolescents according to age and sex.

SEX	AGE												TOTAL
	7	8	9	10	11	12	13	14	15	16	17	18	
MALES	39	28	24	23	24	26	31	27	51	37	35	24	369
FEMALES	31	24	23	24	35	21	31	29	41	48	40	33	380
SUM	70	52	47	47	59	47	62	56	92	85	75	57	749

The drop-out rate for the younger age group was 7,6 % and 23,7 % for the older age group (Table 3). The socioeconomic structure of the 7-14 year olds was regarding education level of the parents near the average for Malmö. In 15-18 year olds the socioeconomic structure was somewhat below average for Malmö regarding both education and income.

Table 3. Causes of drop outs among 132 children and adolescents between 7 and 18 years of age (M = male, F = female).

CAUSE	7 M F	8 M F	9 M F	10 M F	11 M F	12 M F	13 M F	14 M F	15 M F	16 M F	17 M F	18 M F
ABSENT IN SPITE OF SEVERAL SUMMONS	1 2	1	3 1	3 3	5 1	1 3	1	1	1 1	5	6 3	15 13
ILLNESS		1				1 1	2	2				
MOVED FROM THE AREA						1			1	1 4	2 1	5 5
UNCODEABLE EXA - MINATION FORMS				2								
REFUSED TREAT - MENT AT THE SCHOOL CLINIC									1	2		1
PREVENTED BY EMPLOYER												3 1
UNWILLING TO PARTICIPATE									3 3	1 3	2 5	3 3
TOTAL	1 2 3	1 1 2	3 1 4	5 3 8	5 1 6	3 4 7	3 0 3	3 0 3	4 6 10	2 14 16	10 9 19	26 25 51

METHODS

The 749 children and adolescents were investigated by means of a special examination form. They were interviewed and clinically examined.

Interview. Only head and facial pain which occurred more than once a week was recorded. Questions were asked about pain when opening the mouth wide or when chewing, as well as difficulties in opening wide and the occurrence of temporomandibular joint sounds. The children and adolescents were also asked about trauma to the face, orthodontic treatment, and if they were aware of oral parafunctions such as grinding, clenching, lip-cheek-biting, nailbiting and thumbsucking.

Clinical examination. Asymmetry (>5 mm from the midline of the face) of the lower jaw was recorded with the aid of a transparent sheet marked with three parallel lines 5 mm from each other. The intermaxillary relationship in the permanent dentition was assessed at the first molars and canines and was classified into neutral, mesial and distal relation. Mesial and distal relation was defined as more than half a cusp widths's displacement from neutral relation (Ingervall, Seeman & Thilander 1972). The intermaxillary relationship in the primary dentition was recorded according to Moyers (1963). Open bite was recorded if the vertical overbite was negative and there was no occlusal contacts at all in the front (cuspid to cuspid). Deep bite was recorded if the upper front teeth covered more than half of the length of the crowns of the lower front teeth. Single- and double-sided interferences in the retruded contact position (RP) were recorded when a vertical difference between RP and intercuspal position (IP) was observed by the naked eye.

Mediotrusion interferences during any stage of lateral movement were recorded when their contact surfaces appeared as shining facets. Cuspid rise was recorded when only the canines on the laterotrusion side were in contact with each other at the beginning of the lateral movements or when the laterotrusion ended with just contact between the canines. The following criteria for dental wear was used (Hansson & Nilner 1975):

1. dental wear of the enamel only
2. dental wear of the enamel and dentine
3. dental wear of up to 1/3 of the length of the crown or noticeable wear of the facial or lingual surface
4. dental wear to pulp lesion or more than 1/3 of the length of the crown.

Palpation of the temporomandibular joints (TMJ) and TMJ musculature was carried out bilaterally. Right and left side were palpated at the same time except for the lateral and medial pterygoid muscle. Pain on maximal passive opening of the mouth from the joints and muscles was noted. TMJ clicking and crepitation were assessed by a stethoscope. Irregular opening movements and deviations of the lower jaw were observed with aid of the above mentioned transparent sheet. Lateral deviation on protrusion and asymmetrical lateral movement capacity (i.e. a greater mobility in one lateral direction than the other) was assessed by marking the projection of incision superior on the buccal surface of the lower central incisor in IP. A recording was made if the deviation on protrusion and difference in lateral movement capacity was greater than 2 millimeters.

Maximal mouth opening capacity was measured between incision superior and its horizontally marked projection on the buccal surface of the lower jaw in-

cisors.

Part I and III of the investigation were carried out by three persons MN (256 subjects), KN (20) and S&L (164), while part II and IV were undertaken by one examiner (MN).

STATISTICAL METHODS

The chi-square test was used for statistical analyses of correlations and differences between investigators and recorded variables. The correlations to age were also tested by Spearman rank correlation coefficient, R_s . The following levels of statistical significance were used and are denoted by N.S. (not significant) $p \geq 0.05$, * $0.01 \leq p < 0.05$, ** $0.001 \leq p < 0.01$ and *** $p < 0.001$. The computer program used was Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner & Bent, 1975).

RESULTS

Interview (I, II)

Thirty-six per cent of the children and 41% of the adolescents reported symptoms according to 7 questions in the interview. Fig. 2 shows the distribution of affirmative answers to those questions. Recurrent headaches were common among all age groups 14% (7-14) and 16% (15-18), respectively. Clickings were reported by 13% in the youngest age group and by 17% in the oldest age group.

Oral parafunctions were found in 77% of the children (7-14) and 74% of the adolescents (15-18). They reported some form of parafunction such as: grinding, clenching, lip-cheek-biting, nailbiting and thumb-sucking. Fig. 1 shows the distribution of parafunctions in the two age groups.

Fig. 1. The prevalence of oral parafunctions in the two age groups, 7-14 years old ($n = 440$) and 15-18 years old ($n = 309$). Expressed as percentage.

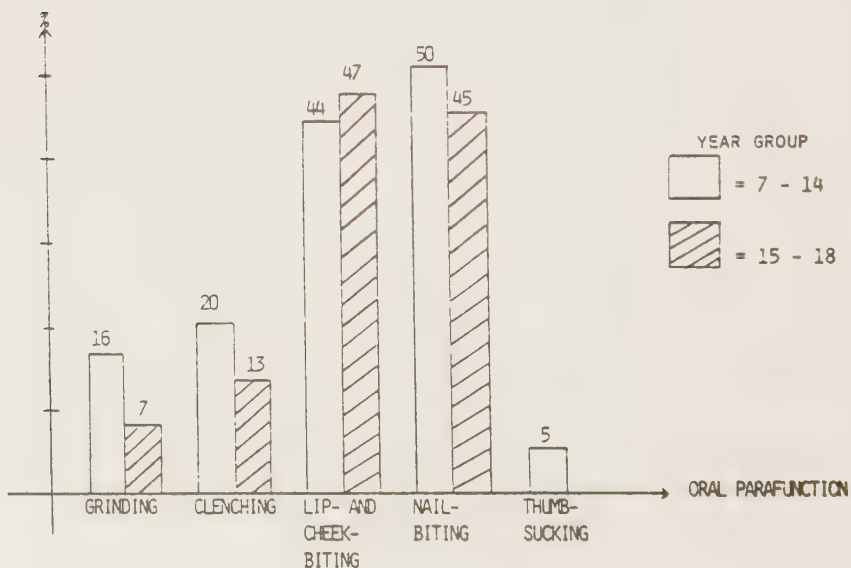


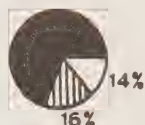
Fig. 2. Symptoms from the stomatognathic system expressed as a percentage of 440 children aged 7-14 and 309 adolescents aged 15-18.

AGE-GROUPS

7-14

15-18

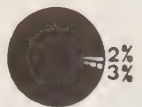
1. Do you (or did you) suffer from headaches (more than once a week)?



2. Do you (or did you) have pain in the temple region?



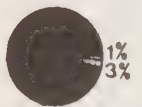
3. Do you (or did you) have pain anywhere else in your face?



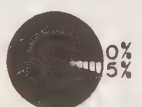
4. Is it (or was it) painful when opening wide?



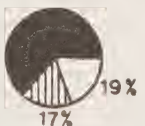
5. Is it (or was it) painful when chewing?



6. Do you (or did you) ever notice restricted opening?



7. Do you (or did you) ever notice clicking sounds from your temporomandibular joints?



□ = PREVIOUSLY ▨ = CURRENTLY

Clinical examination (I, II)

The intermaxillary relationship and the malocclusions recorded in the two age groups are presented in Table 4.

Table 4. Intermaxillary relationships and malocclusions in per cent among 749 individuals 7 - 18 year old.

INTERMAXILLARY RELATIONSHIPS AND MALOCCLUSION	AGE	
	7 - 14	15 - 18
NEUTRAL OCCLUSAL RELATION	84	89
DISTAL OCCLUSAL RELATION	14	7
MESIAL OCCLUSAL RELATION	2	4
CROSSBITE	9	14
SCISSORS-BITE	1	3
INVERSION	7	1
OPEN BITE	27	6
DEEP BITE	15	20

Occlusal interferences in the terminal hinge movement and mediotrusion interferences are shown in Table 5.

Table 5. Percentage of children with occlusal interferences in RP and mediotrusion interferences (n = 749).

OCCLUSAL INTERFERENCES	AGE	
	7 - 14	15 - 18
<u>OCCLUSAL INTERFERENCES</u>		
<u>IN RP:</u>	79	83
RIGHT SIDE	23	30
LEFT SIDE	43	42
BOTH SIDES	13	11
<u>MEDIOTRUSION INTERFERENCES:</u>		
RIGHT SIDE	5	5
LEFT SIDE	8	6
BOTH SIDES	65	66

More than half of the children (64%) and adolescents (55%) exhibited muscles tender to palpation. The prevalence figure for tenderness of the temporal and masseter muscles in the two age groups are seen in Table 6.

Table 6. Occurrence in per cent of tenderness on palpation in the masseter and temporal muscles in 7 - 18 year olds (n = 749).

TMJ-MUSCLES TENDER ON PALPATION	AGE	
	7 - 14	15 - 18
<u>TEMPORAL MUSCLE</u>		
(ANTERIOR PORTION)	27	17
ATTACHMENT OF TEMPORAL MUSCLE	32	20
MASSETER MUSCLE	26	17

Thirty-nine per cent in the 7-14 age group and 34% in the 15-18 age group stated that they experienced tenderness in the temporomandibular joints on palpation. About 20% of the two age groups had tenderness both laterally and posteriorly except for lateral palpation in the 7-14 age group where the figure was 31%.

Clicking sounds were found in both children and adolescents (8% and 14%, respectively). The clickings were mostly unilateral with the prevalence figures 6% in children and 10% in adolescents.

The average value for maximal active mouth opening in the 7-14 age group was 51 millimeters and 56 millimeters for the 15-18 age group. The mean value of mouth opening capacity at 7 years of age was 47 millimeters and then the capacity increased with age to 15 years, where it seemed to have reached its maximum, 58 millimeters.

Correlations between symptoms, signs, oral parafunctions and occlusal findings (III, IV)

Statistically significant correlations found between symptoms, signs, oral parafunctions and occlusal findings in both age groups are shown in figures 3, 4 and 5.

Symptoms (see fig. 2) were reported more often among adolescents (15-18) with audible clickings ($p < 0.001$), TMJ muscles tender to palpation ($p < 0.001$), distal occlusion ($p < 0.01$) and mediotrusion interferences ($p < 0.01$).

Headaches were strongly correlated to oral parafunctions in both age groups. There were also correlations found between recurrent headaches and tenderness to palpation of TMJ-muscles such as temporal and masseter muscles (see figures 3, 4 and 5).

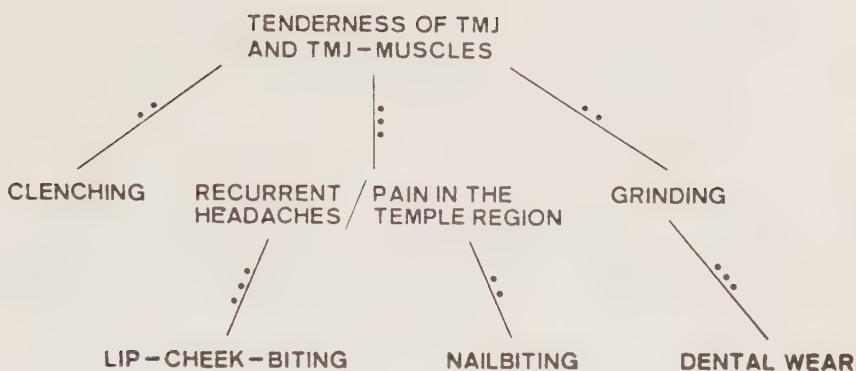


Fig. 3. Statistically significant correlations between symptoms, oral parafunctions, tenderness to palpation of the TMJ and TMJ-muscles and dental wear in the age group 7 - 14.

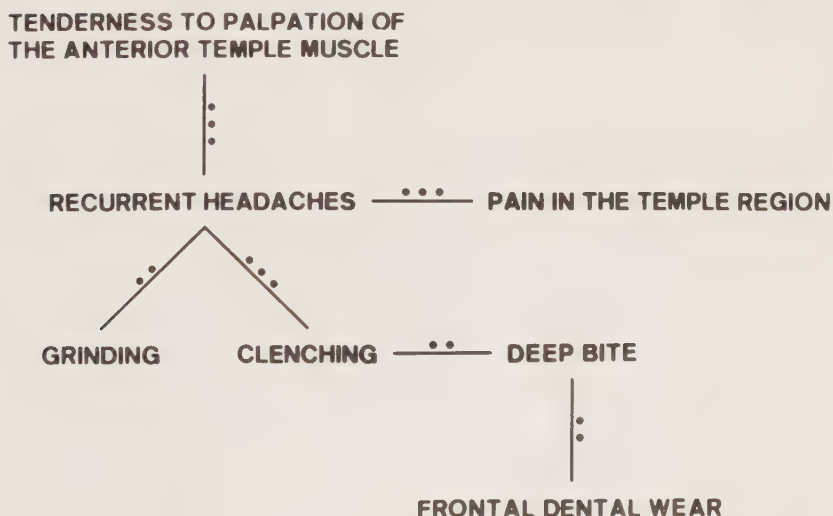


Fig. 4. Statistically significant correlations between symptoms, oral parafunctions, signs, malocclusion and dental wear in the age group 15 - 18.

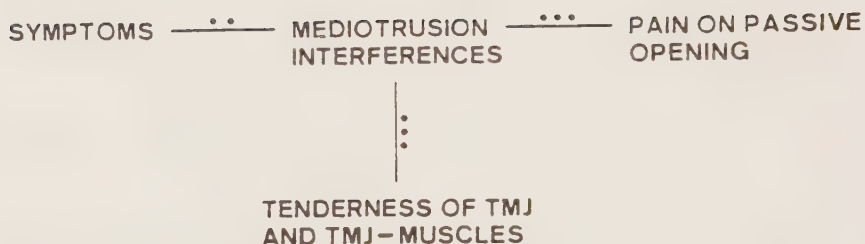


Fig. 5. Statistically significant correlations between symptoms, tenderness to palpation of the TMJ, TMJ-muscles and occlusal interferences in the age group 15-18.

Frontal dental wear was correlated to nailbiting ($p < 0.001$) among children and to deep bite ($p < 0.001$) among adolescents. Interferences in RP, distal occlusal relation and mediotrusion interferences were significantly correlated to irregular mandibular movements ($p < 0.01$ and $p < 0.001$). Clickings were in the age group 15-18 correlated to interferences in RP ($p < 0.05$). Lip-cheek-biting was correlated to interferences in RP ($p < 0.01$).

Distribution by age and sex of functional disturbances and diseases of the stomatognathic system (V)

There was no statistically significant difference in symptoms between boys and girls, when the presence of at least one symptom was considered. The symptoms showed a weak but statistically significant increase with age ($R_s = 0.07$, $p < 0.05$).

Recurrent headaches did not show any statistically significant correlation to age. Girls in the age 7 - 14 reported headaches more often than boys ($p < 0.01$).

Clickings were positively and significantly but weakly correlated to age ($R_s = 0.09$, $p < 0.01$). No difference in prevalence between sexes was found. Both grinding and clenching showed a significant negative correlation to age ($R_s = -0.16$ and $R_s = 0.13$ respectively, $p < 0.001$). Lip-cheek-biting and nail-biting were frequently (45-50%) reported in all ages investigated.

DISCUSSION

This was a cross-sectional epidemiologic study to examine functional disturbances and diseases of the stomatognathic system in 7-18 year old children and adolescents. The individuals were randomly selected and nearly as many boys as girls were included. The drop out rate was nominal in the younger age group, 7-14, and somewhat higher in the older age group 15-18. Especially in the age of 18 the drop outs were numerous. These adolescents did not attend to the examination in spite of several summons. Nevertheless, there is no reason to believe that these individuals differed from the examined ones or that they did not appear for the reason that they suffered from symptoms which would be of interest to this study.

The participants parents were compared with respect to socioeconomic stature and education in this study. The education of the parents in the younger age group, was near average for Malmö while the income was somewhat higher than average. The educational and economic level of the parents in the older age group were both somewhat lower than average for Malmö. The population sample of this study deviated somewhat in these socioeconomic conditions from parents in general of children and adolescents in the age group 7-18 in Malmö.

The children and adolescents reported symptoms at interviews preceding the clinical examination. The errors of the interview technique are difficult to evaluate. An interview is, according to Svedner (1977) preferable to a questionnaire because, the identity of the interviewed individual can be confirmed. It is also possible to find out whether a question has been understood or not. Since young children were interviewed in this study it was imperative to know

that the questions were understood. Direct contact with the children helped to achieve the understanding, which was needed for this study. A questionnaire sent to the home could possibly give answers from the parents instead of the children. These differences between interview and questionnaire should be kept in mind when this study is compared with other studies. A difficult task was to ask questions concerning symptoms and signs of functional disturbances and diseases to small children, since they were unfamiliar with this type of questions. There was always the risk that they have been too co-operative and therefore have answered affirmatively on false grounds. It was, however, the examiners experience that the children were accurate.

The methods of clinical examination in this investigation have long been used as standard procedures at departments of Stomatognathic Physiology and in clinical research. Different aspects of the techniques have been evaluated (Ingervall 1971, Helkimo, Ingervall & Carlsson 1971, Carlsson & Helkimo 1972, Lindqvist 1973, Kopp 1977, Carlsson, Egermark-Eriksson & Magnusson 1980).

The prevalence figures of tenderness to palpation of the TMJ and TMJ-muscles in children and adolescents differ between investigators (Geering-Gaerny & Rakosi 1971, Grosfeld & Czarnecka 1977, Egermark-Eriksson, Carlsson & Ingervall 1981, Nilner 1981, Nilner & Lassing 1981) and this is probably partly due to different palpation techniques and to different definitions of tenderness. The evaluation of the individual response to the palpation is also very important. In the study by Egermark-Eriksson, Carlson & Ingervall (1981) *pain* to palpation of the TMJ and TMJ-muscles was noted as differences between sides. In the investigations by Nilner (1981) and Nilner & Lassing (1981) *tenderness* to palpation was recorded when the children

or adolescents reported tenderness to the palpation. A different meaning of tenderness and pain as well as the necessity of a difference between sides might partially explain the deviation in prevalence figures. Palpation of the TMJ and TMJ-muscles on small children was also different from palpation of adults with respect to the size of these structures. The size of the palpating hand is also of importance as a smaller hand can more easily reach the lateral and medial pterygoid muscles.

Geering-Gaerny & Rakosi (1971) have only palpated the lateral pterygoid muscle and Grosfeld & Czarnecka (1977) have not described the palpation technique which make comparison with the present study difficult.

Greene & Marbach (1982) questioned palpatory tenderness as an objective sign since "pain elicited by palpation contains many subjective variables". However, the investigation of Carlsson, Egermark-Eriksson & Magnusson (1980) showed fairly good agreement between observers regarding recordings of pain on palpation. Malmgren (1980) also found a good constancy of tenderness to palpation at double determinations 2-3 weeks apart in 17 children. Tenderness to palpation of the TMJ and the TMJ-muscles can thus be considered to have sufficient reliability as clinical signs to be used in this study.

The prevalence figures of *symptoms* were high in both age groups in this study (36% and 41%, respectively). They were, however, not as high as those reported in 7-, 11- and 15-year olds (39%, 67% and 74%, respectively) in the study by Egermark-Eriksson, Carlsson & Ingervall (1981). All these figures were nevertheless, surprising as earlier works have not reported any subjective symptoms among children (Table 1) except for

Dibbets (1977). The symptoms are, however, mostly mild in character.

Headaches in children are usually not due to organic disease and the most common cause to headaches is muscle contraction (Diamonds & Dalessio 1978). Migraine has for instance been reported in 1.4% and 3% in epidemiologic studies (Bille 1962, Sillanpää 1976). The prevalence of recurrent headaches among the children and adolescents examined in Malmö was well in accordance with earlier presented results (Bille 1962, Øster 1972, Sillanpää 1976, Egermark-Eriksson, Carlsson & Ingervall 1981). There were, however, somewhat higher prevalence figures among the 7-year olds in this study than in the studies by Bille (1962) and Egermark-Eriksson, Carlsson & Ingervall (1981), which could be due to different interviewing technique, different definitions for recurrent headaches and different populations.

Correlations between recurrent headaches and tenderness to palpation of the TMJ and TMJ-muscles have been reported by several authors previously (Agerberg & Carlsson 1973, Helkimo 1974b, Gelb & Tarte 1975, Hansson & Nilner 1975, Molin, Carlsson, Friling & Hedegård 1976, Magnusson & Carlsson 1978, Solberg, Woo & Houston 1979, Lous & Olesen 1982). Such correlations were also found in this study (Fig. 3 and 4) and confirm that recurrent headaches in children and adolescents often are of the muscular contraction type.

The prevalence of *clickings* was high already in the youngest children of this study and the prevalence figures are in accordance with those reported earlier (Geering-Gaerny & Rakosi 1971, Grosfeld & Czarnecka 1977, Egermark-Eriksson, Carlsson & Ingervall 1981).

Different causes for clickings have been discussed in the literature such as deviations in form of the joint, internal derangements and muscular incoordination (de Boever 1979, Hansson & Öberg 1977, Carlsson & Öberg 1979, Westesson 1982). A discrepancy was found between reported clickings and auscultated clickings. One explanation of this is that clickings are intermittent (Kopp 1977, Carlsson, Egermark-Eriksson & Magnusson 1980). The intermittent nature of clickings support disc-displacement and muscular incoordination as usual causes of clickings. The clickings would probably not have been intermittent had they been due to mere deviations in form. The role of occlusal *interferences* as etiological factors to clickings was demonstrated in this study by the correlations found between clickings and interferences in RP (Nilner 1983). Previously an experimental study has shown that occlusal interferences can cause TMJ clickings. (Randow, Carlsson, Edlund & Öberg 1976). The prevalence of interferences in RP and mediotrusion interferences, was higher than that reported by Ingervall (1972) and Egermark-Eriksson, Carlsson & Ingervall (1981), but well in accordance with those presented by Siebert (1975) and Malmgren (1980). The differences in prevalence between the above mentioned studies are probably due to the different definitions of occlusal interferences.

Oral parafunctions were very common in this study especially nailbiting and lip-cheek-biting. *Grinding* had a prevalence figure of 16% in the ages with mixed dentition (7-14 years old). When studying the distribution by age of grinding the frequency was highest in the youngest age group. This is well in accordance with the figures presented by Lindqvist, 15% (1972), Holm 21% (1978) and Egermark-Eriksson, Carlsson & Ingervall 15% (1981). Grinding was reported in 7% of

the participants in the oldest age group. This figure was near to those presented by Agerberg & Carlsson (1972) 10% and Egermark-Eriksson, Carlsson & Ingervall (1981) 10%. Studies of 3-, 4- and 5-year olds by Holm & Andersson (1974) and Holm (1975a, 1975b) showed prevalence figures for grinding of 24, 28 and 32%. Grinding was in those studies reported by the parents. According to above mentioned prevalences there appears to be a high frequency of grinding between 3 and 10 years of age. The prevalence then appears to decrease. Parents in Holm's study (1978) reported that 21% of the 8-year old children were grinders, 7% of the children had had their habit of grinding since the age of 3. This is interesting as the prevalence in the older age group in this study was 7%. The high prevalence of grinding in the younger ages may be explained by the erupting permanent teeth causing interferences of occlusion and may be a physiologic response in order to equilibrate the occlusion in the mixed dentition.

The prevalence figures for *clenching* were also highest in the youngest age group in this study, but the frequency did not decrease in the oldest age group as much as grinding. Agerberg & Carlsson (1972) have reported from their study that 13% of the individuals in the age group 15-24 had the habit of clenching. Egermark-Eriksson, Carlsson & Ingervall (1981) have reported 10% clenchers among the 15-year olds. This decrease in frequency of clenching could have the same explanation as mentioned for grinding. Lip-cheek-biting and nailbiting were evenly distributed by age which also was the case in the investigation by Egermark-Eriksson, Carlsson & Ingervall (1981). These parafunctions are therefore not likely associated with the development of occlusion.

The correlations found between oral parafunctions, recurrent headaches and tenderness to palpation of

the TMJ and TMJ-muscles in the youngest age group indicate that oral parafunctions are etiological factors of recurrent headaches. This has already been suggested in earlier studies in adults (Olkinoura 1972, Molin, Carlsson, Friling & Hedegård 1976, Magnusson & Carlsson 1978). Geering-Gaerny & Rakosi (1971) have reported correlations between lip-cheek-biting and signs of functional disturbances. It was therefore interesting to find in this study correlations between nailbiting, lip-cheek-biting and headaches. These oral parafunctions appear to play a role in the etiology of headaches, although there was no direct correlation found to tenderness to palpation of TMJ-muscles (Fig. 3). In the oldest age group correlations between grinding, clenching and headaches were found. It was remarkable that there were no correlations found between bruxism and tenderness to palpation of the TMJ and TMJ-muscles which were found in the younger age group. The explanation to this incongruity may be that there are still factors to investigate before the relationships between oral parafunctions and recurrent headaches are fully understood.

The etiology of functional disturbances and diseases have in the literature been claimed to be multifactorial (de Boever 1979). One etiological factor often discussed is the occlusal one (Carlsson 1978). In this study many correlations have been found between symptoms and signs and occlusal factors such as distal occlusal relation, mediotrusion interferences and interferences in RP. Solberg, Woo & Houston (1979) among others found a statistically significant correlation between asymmetrical lateral deviation between RP and IP and tenderness to palpation of the lateral pterygoid. Egermark-Eriksson, Ingervall & Carlsson (1981) found that the variation in Helkimo's clinical dysfunction index could partly be explained by interferences in RP. These correlations indicate that occ-

lusal factors play an etiologic role, but not to what degree, i.e. the correlations are statistically significant but their strength and their relative clinical importance are still largely unknown.

CONCLUSIONS

1. Symptoms of functional disturbances and diseases of the stomatognathic system are common among children and adolescents.
2. The most common symptoms are recurrent headaches and clickings in the age group 7 - 18. Clickings increase by age.
3. Oral parafunctions are common. Grinding and clenching decrease by age between 7 - 18, while nailbiting and lip-cheek-biting are evenly distributed by these ages.
4. Interferences in RP and mediotrusion interferences are common in ages 7 - 18. Correlations between these occlusal interferences and irregular movements of the mandible, tenderness to palpation of the TMJ and clickings, indicate that these occlusal interferences are etiological factors in the development of symptoms of functional disturbances and diseases of the stomatognathic system.
5. Correlations between recurrent headaches and tenderness to palpation of TMJ-muscles and TMJ in children and adolescents indicate that recurrent headaches are often of muscle contraction type in children and adolescents.
6. Correlations between recurrent headaches and grinding, clenching, nailbiting and lip-cheek-biting suggest that oral parafunctions play an etiologic role in the development of recurrent headaches.
7. Distal occlusal relation appears to be a risk factor for the development of symptoms of functional disturbances and diseases of the stomatognathic sys-

tem in the age 15 - 18.

8. There is no general difference between the sexes regarding the prevalence of oral parafunctions or symptoms and signs of functional disturbances and diseases of the stomatognathic system.

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Prevalence of functional disturbances and diseases of the stomatognathic system in 7-14 year olds

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Key words: Functional disturbances, stomatognathic system, children

ABSTRACT

An epidemiological investigation was carried out in Malmö/Sweden to determine the prevalence of symptoms and signs of functional disturbances and diseases of the stomatognathic system in children aged 7-14. Four-hundred and forty children (440) were randomly selected, interviewed and clinically examined. The interview revealed 36% with symptoms, 15% with recurrent headaches and 13% reported clicking sounds from the temporomandibular joints. Seventy-seven per cent (77%) of the children reported at least one of the following oral parafunctions: grinding, clenching, lip- and cheek-biting, nail-biting or thumb-sucking. In the clinical examination occlusal interferences in RP were found in 79% and mediotrusion interferences in 78%. More than half of the children, 64%, claimed pain on palpation of the temporomandibular joint muscles and more than one third (39%) claimed pain on palpation of the temporomandibular joint. It is concluded that children are suffering from diseases and functional disturbances of the stomatognathic system.

SAMMANFATTNING

En epidemiologisk undersökning av barn i åldern 7-14 år genomfördes i Malmö, för att fastställa prevalensen av subjektiva och objektiva symptom, vilka kan ha samband med funktionsstörningar och sjukdomar i tuggapparaten. Fyrahundrafyrtio (440) slumpmässigt utvalda barn intervjuades och undersöktes kliniskt. Från intervjun framkom att 36% av barnen hade något subjektivt symptom, 15% ständigt återkommande huvudvärk och 13% påstod att de hade käkledsknäppningar.

Sjuttiosju procent (77%) av barnen påstod sig ha en av följande orala parafunktioner: tandgnissling, tandpressning, läpp-kind-bitning, nagelbitning eller tumsugning. Från den kliniska undersökningen framkom att hos 79% fanns interferenser i RP och mediotrusionsinterferenser i 78%. Mer än hälften av barnen, 64%, påstod att det smärtade vid palpation av käkledsmuskler och mer än en tredjedel (39%) påstod att det smärtade vid palpation av käklederna. Sammanfattningsvis kan sägas att barn har symptom som tyder på funktionella störningar och sjukdomar från tuggapparaten.

INTRODUCTION

Several epidemiological studies of functional disturbances in the masticatory system have been published. *Helkimo* (1976) has compiled the results of these studies and concluded that at least 50% of the Swedish adult population show such disturbances. The symptoms

occur among all age groups and there is no significant difference in frequency between men and women. In clinical materials there is an overrepresentation of young people, women, well-educated, and people from the higher social groups. Epidemiological studies have

[illegible]

suggest functional disturbances and diseases of the stomatognathic system in children aged 7-14 in Malmö, Sweden.

MATERIAL

Four-hundred and forty (440) children (222 boys and 218 girls) aged between 7 and 14 were examined in the autumn of 1976 and the spring of 1977 at two school dental clinics in Malmö. The head of the dental care authority allotted two clinics (LA and RG) where dental offices could be used several hours per week. School-classes 1-6 at LA and 1-8 at RG were available. The numbers on roll were 1415. Every third child in the school registers was called to an examination, in all 476 school-children. Thirty-six children (7.6%) were absent from the examination. Table 1 shows the reasons for absence. Table 2 shows the age and sex distribution of the subjects examined at each clinic.

SOCIOECONOMIC STRUCTURE

The Education Committee in Malmö, in conjunction with the statistical unit of the local Finance Department, carried out an examination of social variables to describe the social profile of the pupil sample in the different school catchment areas 1976. Six different types of relationships were calculated:

a) children aged 0-15/the population total

Table 2. Distribution of 440 examined children according to age, sex and clinic.

Age (years)	Boys		Girls		Total
	LA	RG	LA	RG	
7	18	21	14	17	70
8	19	11	12	12	52
9	24	0	23	0	47
10	23	0	24	0	47
11	8	16	16	19	59
12	10	16	14	7	47
13	0	31	0	31	62
14	0	27	0	29	56
	102	116	105	117	440

- b) foreign citizens aged 0-15/the total 0-15 age group
- c) people who have moved into or out of the catchment areas/the population total
- d) income units with less than 30,000 SEK annual income/total number of income units
- e) early school leavers aged 16-59/the total number of persons aged 16-59
- f) persons on social welfare/the population total.

The calculations were based on the number of children and of immigration according to statistics as of the first of January 1976. Population mobility is expressed in proportion to the total population at the end of the year. Income figures were taken from tax assessments for 1975, and refer to 1974 incomes. The statistics on educational background were taken from the 1970 census. The numbers on social welfare show the position in 1974 in relation to the population total at the end of the year. The ratios were expressed as

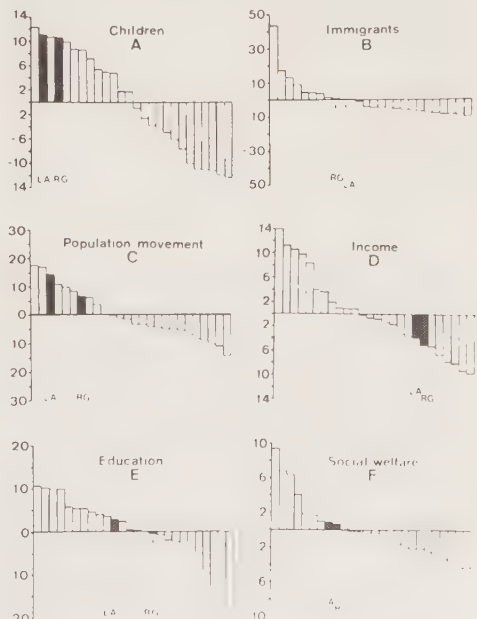


Fig. 1 a-f. Social profile of the school districts within Malmö 1976. Percentage deviations in relation to the average for the city.

percentages. The mean for all the school catchment areas in Malmö was calculated and given a value of 0. Then the value for each school district was set in relation to the mean value. The social profile of LA school (LA-clinic) and RG school (RG-clinic) in relation to other districts in Malmö is illustrated in the diagrams (Fig. 1 a-f), which show the percentage deviations in relation to the average for the city.

METHODS

The 440 children were investigated in accordance with a special examination form (see Appendix). After an interview, a clinical examination was carried out.

INTERVIEW

Only head and facial pains which occurred more than once a week were registered. Positive answers to the question about pain when the mouth is opened wide or when chewing were noted, as were difficulties in opening wide and the occurrence of temporomandibular joint sounds.

The children were also asked about trauma to the face, orthodontic treatment, and if they were aware of oral parafunctions such as grinding, clenching, lip- and cheek-biting, nail-biting and thumbsucking.

CLINICAL EXAMINATION

If the sagittal midline of the lower jaw deviated more than 5 mm to the symmetry line for the upper 2/3 of the face, it was recorded as lower jaw asymmetry. A transparent sheet with three parallel lines was used as an aid in recording lower jaw deviation: a green centre line, on either side of which were two red lines at a distance of 5 mm. The green line was placed to coincide with the symmetry line for the upper 2/3 of the face. Where the average line of the chin fell outside either of the two red lines, asymmetry was recorded.

The intermaxillary relationship in the permanent dentition was observed at the first

molars and canines in neutral, mesial and distal relation. Mesial and distal relation presupposed more than 1/2 cusp width's displacement (*Ingervall, Seeman & Thilander 1972*). The intermaxillary relationship in the primary dentition was recorded as neutral when the distal surfaces of the last primary molars in the upper and lower jaws coincided in the frontal plane. Mesial and distal relation in the primary dentition was recorded when more than 1/2 cusp width's displacement occurred compared with the normal relationship (*Moyers 1963*). Crossbite, scissors-bite and frontal inversions were noted. Open bite was recorded if the vertical overbite was negative and there was no contact cuspid to cuspid with the corresponding teeth in the lower jaw. Deep bite was judged to exist if the front of the upper teeth covered more than half the length of the crowns of the lower front teeth. The observations were made with the lower jaw in intercuspal position. The loss of more than two teeth per quadrant was noted.

Occlusal interferences in the terminal hinge movement of the lower jaw were recorded. The investigator guided the lower jaw into a retruded contact position (*Helkimo, Ingervall & Carlsson 1971*). Single- or double-sided interferences in this contact position were registered (aid: Kerr Casting Wax sheets, green-soft no 28) where a vertical difference between retruded contact position and intercuspal position was observable to the naked eye. In addition, occlusal sounds during terminal hinge movements were observed. Occlusal interferences are indicated by a soft, indistinct sound (*Watt 1967, 1970*). The observations were then supplemented by questioning the children as to which side the teeth first made contact during repeated passive terminal hinge movements. Interferences on the mediotrusion side were noted when contact surfaces were visible as shining facets. Mediotrusion interference during any stage of lateral movement was recorded with the aid of the articulation wax. Cuspid rise was recorded when only the

canine teeth on the laterotrusion side were in contact at the beginning of the lateral movement or when the laterotrusion was ended with just contact between the laterotrusion canines. The following grades of dental wear were noted (*Hansson & Nilner 1975*):

1. dental wear of the enamel only
2. dental wear of the enamel and dentine
3. dental wear of up to 1/3 of the length of the crown or noticeable wear on the facial or lingual surface
4. dental wear to pulp lesion or more than 1/3 of the length of the crown.

Tenderness and irregularities of movement were registered by palpation of the temporomandibular joints and musculature. The palpation was carried out bilaterally except for the lateral and medial pterygoid muscle. Pain from the joints and muscles was also noted at passive opening of the mouth by the examiner. Reduced mobility when opening wide was noted if one or both temporomandibular joints failed to show palpable translation movement.

Temporomandibular joint sounds like clicking or crepitation were observed by aid of a stethoscope. Irregular mandibular movements were examined in front of the child, who was repeatedly requested to open and close the mouth. Deviation of the chin was observed during the opening movement and at maximum opening with the aid of the transparent sheet described above.

Deviation at protrusion was registered by marking incision superior on the buccal surface of the lower central incisors in intercuspal position. The child was asked to push the chin forward as far as possible. Deviations in excess of 2 mm between incision superior and the marked line were noted. The size of the lateral movement was measured in mm with a steel ruler with aid of the same marks. Asymmetrical lateral movement capacity (i.e. a greater mobility in one direction than the other one) in excess of 2 mm was noted. Maximal mouth opening capacity was measured as the distance between incision superior and its

horizontally marked projection on the buccal surface of the lower jaw incisors. The child was encouraged to open as wide as possible and then "a little bit more".

INVESTIGATORS

The investigation was carried out by three persons. The total number of children was for MN 256, KN 20 and for SÅL 164. Before the start of the examination, investigators MN and SÅL practised palpation of the temporomandibular joints and muscles on individuals selected at random in order to get coordination in judging palpatory findings.

STATISTICAL ANALYSIS

Data from the examination form were computerized using Univac 1100. The programme used was Statistical Package for the Social Sciences. (*Nie, Hull, Jenkins, Steinbrenner & Bent 1975*). The Chi-square-test was used for statistical analysis of the difference between the results of the investigators. The levels of significance taken into consideration were $0.001 < p < 0.01$ and $p < 0.001$ with regard to the size of the sample.

RESULTS

INTERVIEW

The frequency of positive answers indicating symptoms is illustrated in Fig. 2. Thirty-six per cent (36%) of the children were aware of one or more symptoms at the time of the examination. Nineteen per cent (19%) suffered from frequently occurring headaches or pain in the region of the temples. Fifteen per cent (15%) stated that they had, or had previously noticed, clicking sounds in the temporomandibular joint. Clicking, aches in the head and temples, occurred most frequently on both sides. Seventy-seven per cent (77%) of the children claimed some form of parafunction, the distribution of which is shown in Fig. 3. Heavy blows to the face were reported by 14%.

Altogether 15% had previously received orthodontic treatment or were under treatment at the time of the examination (7% and 8% respectively).

CLINICAL EXAMINATION

The intermaxillary relationship recorded was 84% neutral, 14% distal and 2% mesial. Noticeable lower jaw asymmetry was not found in any of the children nor were there more than two teeth missing per quadrant. The number

of children with cross-bite was 9%, scissors-bite 1% or inversion 7%. The frequency of deep and open bite was 27% and 15%, respectively.

Occlusal interferences in the terminal hinge movement were found in 79% and mediotrusion interferences in 78%. Table 3 shows the distribution of different types of interferences. Cuspid rise was discovered in 17%. All the subjects showed signs of dental wear mostly grade 2. Maximum grade of den-

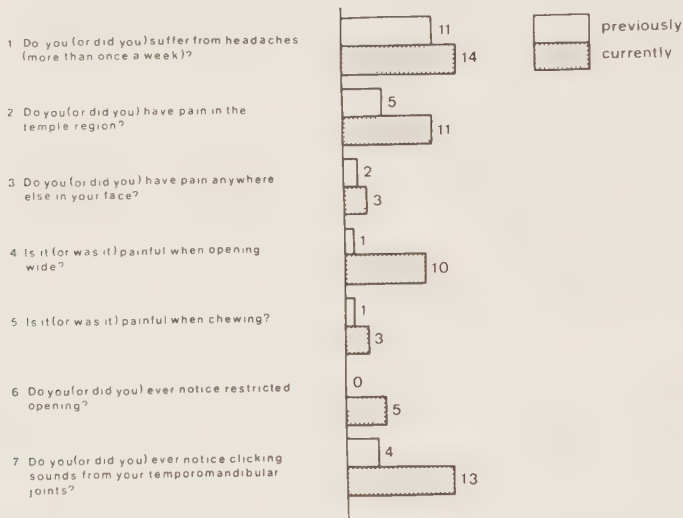


Fig. 2. Symptoms in the masticatory system expressed as a percentage of 440 schoolchildren aged 7-14.

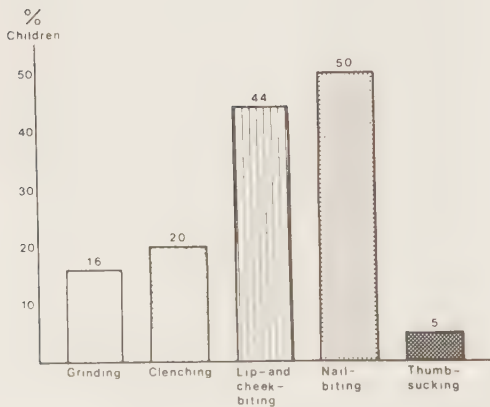


Fig. 3. The frequency of parafunctions in 440 schoolchildren expressed as percentage.

Table 3. The percentage of children with occlusal interferences in RP and with mediotrusion interferences. n = 440.

Occlusal interferences	Localisation			Total
	Only right side	Only left side	Both sides	
Occlusal interferences in RP	23	43	13	79
Mediotrusion interferences	5	8	65	78

tal wear among the children is shown in Fig. 4.

More than half of the children, 64%, reported tenderness on palpation of the TMJ muscles. The posterior belly of the digastric muscle and the attachment of the temporal muscle showed the highest frequencies, 35% and 32% respectively. The prevalence of tender muscles is summarized in Fig. 5.

More than one-third of the children (39%) reported pain on palpation of the temporomandibular joint (31% lateral and 22% posterior). Six per cent (6%) said they experienced pain in one or both sides of the joint area on

passive opening. Temporomandibular joint sounds, in the form of clicking, were recorded in 8% (6% unilateral, 2% bilateral). Crepitation sounds could be recorded in three children.

The opening movement was irregular in 32%. Table 4 shows deviations of movements. They occurred most frequently to the left. The average value for maximal active mouth opening was 50.9 mm (S.D. 5.9 mm) for the whole group. The average values at different ages and sexes are shown in Table 5.

A total of 72% of the children had up to three of the following signs: temporo-

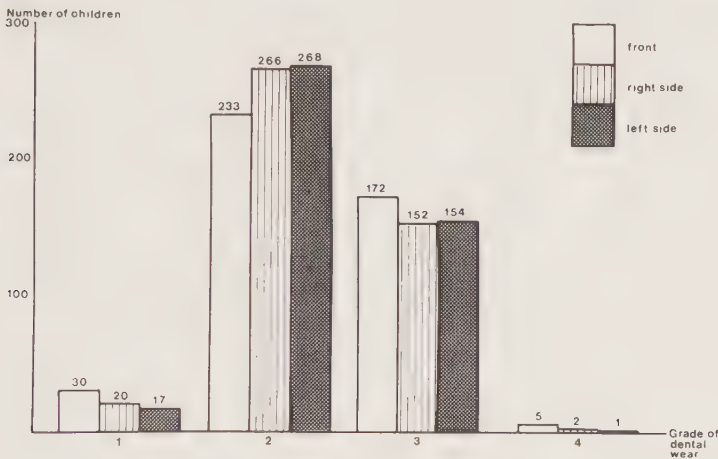


Fig. 4. The total number of children in the age range 7-14 years with dental wear in grade 1-4 and its localization.

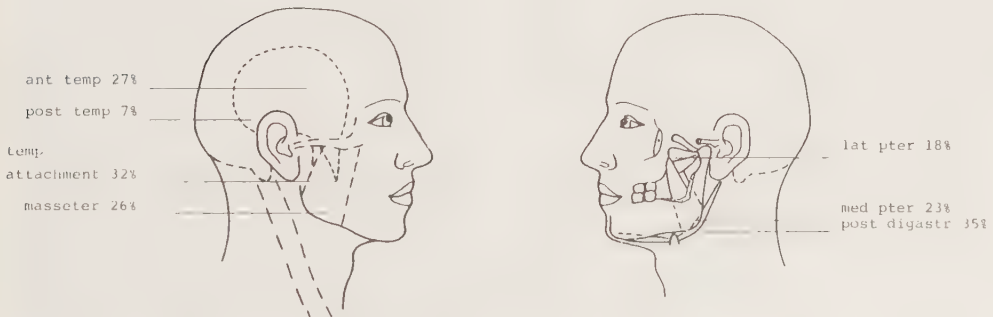


Fig. 5. The occurrence of muscles tender on palpation expressed as a percentage. $n = 440$.

mandibular joint sounds, decreased mouth opening capacity (< 40 mm), temporomandibular joint and muscles tender on palpation, Table 6.

COMPARISON OF THE RESULTS OF THE EXAMINERS

A comparison of the observations made by MN and SÅL revealed significant differences. (MN had examined more girls than SÅL ($p <$

Table 4. The percentage of children with deviation of the chin when opening wide, at protrusion or with asymmetrical lateral mobility capacity. $n = 440$.

Mandibular movements	Deviation to	
	Right	Left
Maximal opening	1	19
Protrusion	6	20
Lateral movement capacity largest to	10	17

Table 5. The average values and standard deviations of maximal opening capacity in the age range 7–14 years. $n = 440$.

Age (years)	Opening capacity (mm)					
	Boys		Girls		Total	
	mean	S.D.	mean	S.D.	mean	S.D.
7	46.8	4.2	47.6	3.9	47.2	4.0
8	48.9	4.7	48.3	4.3	48.2	4.5
9	49.8	5.4	48.0	4.5	48.9	5.0
10	54.3	4.0	50.4	4.6	52.4	4.7
11	50.8	5.5	51.3	9.9	51.1	8.3
12	52.9	5.9	53.0	5.0	52.9	5.5
13	53.5	5.0	54.0	4.4	53.8	4.7
14	52.7	4.8	54.4	5.9	53.6	5.4

Table 6. The number of children with one, two or three signs. $n = 440$.

		Number of individuals	%
TMJ-sounds	C	13	
Decreased range of opening of the mouth < 40 mm	DO	4	
Temporomandibular joints tender on palpation	JP	14	
Masticatory musculature tender on palpation	MP	116	
		147	33.4
	C+DO	1	
	C+JP	3	
	C+MP	11	
	DO+JP	0	
	DO+MP	0	
	JP+MP	141	
		156	35.5
	C+DO+JP	0	
	C+DO+MP	0	
	C+JP+MP	9	
	DO+JP+MP	3	
		12	2.7
	C+DO+JP+MP	0	71.6

0.01)). MN received more positive answers to the questions on present or previous headaches ($p < 0.001$ and $p < 0.01$ respectively) and on the difficulty in opening the mouth wide ($p < 0.001$). MN found less children with interferences in RP than SÅL ($p < 0.001$) but found more of the following muscles tender on palpation: anterior temporal, masseter, medial pterygoid, lateral pterygoid ($p < 0.001$). In addition MN found more temporomandibular joints tender to lateral palpation ($p < 0.001$) and deviation at maximum opening ($p < 0.001$). More children admitted to SÅL that they were grinders ($p < 0.001$). The same investigator discovered more children with asymmetrical movement capacity ($p < 0.001$) and more children with dental wear in the front ($p < 0.001$).

DISCUSSION

Regarding the selection of the age limits of the material, seven years was judged to be the minimal age at which a reliable interview could be conducted. At the upper limit (14 years) the children have got their permanent teeth except for the third molars (Johansson 1971). The period 7-14 years is dynamic in the development of the stomatognathic system. During this period an important stage in the development of the form - function relationship occurs in the stomatognathic system (Björk 1966, Öberg 1977, Möller 1977).

In order to minimize the drop-out rate in the material, the examination was carried out at school dental clinics where it was easy to contact the children, and school work need not to be interrupted for several hours. The low (7.6%) absentee rate was a result of the collaboration between clinic and school. It should be mentioned that the absentee rate in dental school clinics in Malmö in 1979 was 9.6% (Lindén 1980).

Socioeconomic structure has not previously been included in stomatognathic physiological examinations of children. In LA and RG school districts, the results showed

that the wage earners - that is the guardians of the subjects examined - belonged to a higher income bracket than the average in Malmö. The educational standard in both districts was close to the average for the city. This socioeconomic grouping applies to the school clinics as a whole, and no classification was made on the individual basis. Agerberg, Carlsson & Hällqvist (1977) found in their study of 1106 persons aged 15-74 that symptoms of mandibular dysfunction occurred more frequently among individuals from the lower social groups. Bearing in mind the socioeconomic grouping of the children examined, the frequency of symptoms recorded from this point of view should be looked upon as fairly representative for children in the 7-14 age range.

The investigation was conducted as an interview in combination with clinical examination. Several stomatognathic-epidemiological examinations have been performed on this basis (Hansson & Öberg 1971, Helkimo 1974 a, Agerberg & Österberg 1974, Hansson & Nilner 1975, Grosfeld & Czarnecka 1977, Solberg, Woo & Houston 1979). The interview technique is, according to Svedner (1977), preferable to a questionnaire as the interview object's identity can be confirmed, and it is possible to determine whether a question has been misunderstood. Heløe (1972) showed in a study that the reliability of a questionnaire depend on the content of the questions. The presence of dentures was correctly given whilst there often was discrepancy between the number of teeth reported and the number observed at clinical examination. Helkimo (1974 a) found a high degree of agreement between interview results and observations made during the clinical examination, particularly with regard to temporomandibular joint clickings and tenderness of muscles located in the neck region. The advantages of the questionnaire method are, however, that the subject can consider the question calmly, the interview situation is eliminated and the costs for the examination are reduced (Svedner

1977). The youngest children thought the questions sometimes were difficult to understand. Elucidation was therefore necessary. This applied in particular to the questions: "Is it painful when opening wide?" and "Do you ever notice clicking sounds from your temporomandibular joint?" It appears therefore that direct contact is important when studying the prevalence of symptoms in the stomatognathic system in children.

As far as the method of clinical examination is concerned, it has been accepted as standard practice in the different Swedish departments of stomatognathic physiology. The different aspects of the technique have been described and evaluated (*Ingervall 1971, Helkimo, Ingervall & Carlsson 1971, Carlsson & Helkimo 1972, Lindqvist 1973*).

The differences in the results obtained by MN and SÅL (the third investigator KN examined only 5% of the material) can be due to several reasons. One cause could be the individual techniques of the two investigators (*Carlsson, Helkimo & Agerberg 1974, Solberg, Woo & Houston 1979*). The effect of differences in size of the examiner's hands should not be overlooked in the examination of children. *Svebak (1971)* emphasized the great subjectivity in conducting an examination by palpation. Co-training between the examiners is important in reducing observation differences (*Gill et al. 1973*).

Headaches can have a variety of origins (*Lindblom 1978*). A frequently recurring type of headache is tension headache (*Blomberg 1970*). *Bille (1970)* reports in a survey of 8993 children aged 7 to 15 that 2.5% of the 7 year olds, and 15.7% of the 15 year olds, suffered from chronic headaches caused by tension. Several studies have shown a connection between headaches and pain in the temporomandibular joints and muscles, a sign that the pain in several cases emanates from these structures (*Agerberg & Carlsson 1973, Helkimo 1974 b, Gelb & Tarte 1975, Hansson & Nilner 1975, Molin, Carlsson, Friling & Hedegård 1976, Solberg, Woo & Houston 1979, Magnus-*

son & Carlsson 1978). The frequency of headaches among the children was remarkable high, and scarcely less than the figures reported for adult subjects in the above mentioned studies. Results published from an examination of 281 school children aged 8–14 by *Geering-Garney & Rakosi (1971)* showed headaches in up to 10% of the group without any "initial symptom of temporomandibular joint disturbance" and 12% of the group with "at least one symptoms of temporomandibular joint disturbance".

The origins of sounds in the temporomandibular joint, which have been discussed in the literature, are among others: changes in the joint surfaces, deviations in form of the joint components, caput-disc-displacement, and muscular incoordination (*de Boever 1973, Hansson & Öberg 1977, Carlsson & Öberg 1979 b, Isberg-Holm 1980*). Crepitations indicate arthrotic lesions (*Kopp 1977, Carlsson, Kopp & Öberg 1979*). Epidemiological studies among adults have revealed a high frequency of sounds from the temporomandibular joint. *Hansson & Öberg (1971)* recorded joint sounds in 60% among 67-year olds in Dalby, while *Heløe (1979)* reported 19% in 25 year olds. *Grosfeld & Czarnecka (1977)* reported 15% temporomandibular joint sounds in children, a figure close to 13% in the current investigation, according to the interview. However, the clinical examination showed only 8%. The difference could be accounted for by the intermittent nature of clicking. Thus, temporomandibular joint sounds seem to be less usual among younger age groups. Remarkable is the presence of crepitation in three children.

There are several different opinions about the significance of occlusal interferences for the genesis of functional diseases in the masticatory system (*Carlsson 1978*). *Lindqvist (1973)* has shown in a study of children that occlusal interferences are of greater significance among those children who grind their teeth than among those who do not. A study of young adults (*Solberg et al. 1979*) strengthens the view that asymmetrical sliding be-

tween RP and IP has a close link with disorders of the masticatory system. Against this background the high frequency of interferences in RP (79%), and on the mediotrusion side (78%) is alarming or shall be interpreted as representative of a normal population of 7-14 year olds. However, these figures are difficult to compare to the results of other studies as the definitions of the interferences differ.

Dental wear in mixed dentition reflects chiefly the dental wear of the primary teeth. Nevertheless, it is surprising to find that so many children showed dental wear of higher degree (> grade 2).

Frequency figures about tenderness on palpation of temporomandibular muscles among children are difficult to find in the literature. The posterior belly of the digastric muscle showed 35% prevalence of tenderness on palpation. This figure should be interpreted with care, since the muscle is difficult to palpate and as children often are troubled by throat infections and sore tonsils. Palpation in the region may be influenced by such conditions. The attachment of the temporal muscle and its anterior part and the masseter muscle also showed high percentage figures of tenderness on palpation. Those muscles are considerable easier to palpate, and the obser-

vations therefore more reliable. Tenderness on palpation of the temporomandibular joints also showed high figures, which indicate a high prevalence of functional disorders and diseases among children.

Deviations of the mandible in movements occurred mostly to the left. *Grosfeld & Czarnecka* (1977) noted the same leftsided deviations and compared it with the incidence of right-handedness. They explained it as a physiological functional asymmetry, i.e. the lateral pterygoid muscle on the right side was stronger. The opening capacity of the mouth (Table 5) seems to gradually increase between the ages of 7 and 14. The finding correspond well with previous investigations among children (*Nevakari* 1960, *Sheppard & Sheppard* 1965, *Ingervall* 1970, *Agerberg* 1974 a, b, c, *Landtving* 1978). Opening capacity is less in children than in young adults.

The number of children with one, two or three of the signs in Table 6 was 71.6%. This value is close to those presented for other material (*Hansson & Nilner* 1975, 79%; *Grosfeld & Czarnecka* 1977, 67.6% among 13-15 year olds and 56.4% in 6-8 year olds; *Solberg et al.* 1979, 76%). This is an indication that also children are suffering from functional disturbances and diseases of the stomatognathic system.

EXAMINATION FORM

Date of examination:

Name:

Date of birth

--	--	--	--	--	--	--	--	--	--

Sex

--	--

R = right side

L = left side

F = front

HISTORY

1. Do you (or did you) suffer from headaches?
(More than once a week.)Now
Previously

R	L

2. Do you (or did you) have pain in the temple region?

Now
Previously

3. Do you (or did you) have pain anywhere else in your face?

Now
Previously

4. Is it (was it) painful when opening wide?

Now
Previously

5. Is it (was it) painful when chewing?

Now
Previously

6. Do you (or did you) ever notice restricted opening?

Now
Previously

7. Do you (or did you) ever notice clicking sounds from your
temporomandibular joints?Now
Previously

8. Have you had any strong blows to your face?

Now
Previously

9. Orthodontic treatment?

Now
Previously

10. Habits:

Grinding

Clenching

Lip-biting and/or cheek biting

Nailbiting

Thumb-sucking

Remarks:

STATUS

Jaw asymmetry

deviated

☐ > 5 mm

Missing teeth

more than two per
quadrant are missing

--	--

Occlusal classification after Angle

I
II : 1
II : 2
IIIPerm.
denti-
tion

R	L

Cross bite

Scissors bite

Anterior cross bite

Open bite

Deep bite

OCCLUSAL INTERFERENCES

Interferences in the terminal hinge movement (RP)

Mediotrusion interferences

Cuspid Rise

**GRADE OF DENTAL WEAR**

1 = dental wear of enamel only

2 = dental of enamel and dentine

3 = dental wear of up to 1/3 of the length of the crown or noticeable wear on the lingual or facial surface

4 = dental wear to pulp lesion or more than 1/3 of the length of the crown

**MUSCLES**

Pain on palpation of:

anterior temporal m.

posterior temporal m.

attachment of temporal m.

masseter m.

medial pterygoid m.

lateral pterygoid m.

posterior belly of digastric m.

**TEMPOROMANDIBULAR JOINTS**

Lateral tenderness on palpation

Posterior tenderness on palpation

Pain in passive opening

Restricted mobility in opening

Clickings (with stethoscope)

Crepitations (with stethoscope)

**MANDIBULAR MOVEMENTS**

Irregular movements (in opening)



Deviation in maximal opening

Deviation in protrusion to

Asymmetrical lateral movement capacity largest to



Maximal active opening

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Prevalence of functional disturbances and diseases of the stomatognathic system in 15-18 year olds

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Key words: Functional disturbances, stomatognathic system, adolescents

ABSTRACT

Three hundred and nine teenagers were interviewed and clinically examined in an stomatognathic epidemiological study of young people aged 15-18 in Malmö, Sweden. The youngsters were randomly selected. Forty-one per cent (41%) claimed symptoms, 16% recurrent headaches and 17% had noticed clicking sounds from the temporomandibular joints. At least one of following parafunctions: grinding, clenching, lip- and cheek-biting, nailbiting were stated by 74% of the young adults. Occlusal interferences were found in 83% and mediotrusion interferences in 77%. More than half (55%) of the young people exhibited temporomandibular joint muscles tender on palpation and 34% stated that they experienced pain on palpation of the temporomandibular joints. It is concluded that there is a higher prevalence of symptoms among the young adults than among children (*Nilner & Lassing* 1981).

SAMMANFATTNING

Trehundranio slumpmässigt utvalda tonåringar intervjuades och undersöktes kliniskt i en bettfysiologisk epidemiologisk undersökning av ungdomar i åldern 15-18 år. Fyrtioen procent (41%) angav något subjektivt symptom, 16% ständigt återkommande huvudvärk och 17% sade sig ha käkledsknäppningar. Åtminstone en av följande orala parafunktioner: tandgnissling, tandpressning, läpp-kindbitning eller nagelbitning, angavs av 74% av ungdomarna. Ocklusala interferenser i RP fanns hos 83% och mediotrusionsinterferenser i 77%. Mer än hälften (55%) av ungdomarna angav smärta vid palpation av käkledsmuskler och 34% påstod att det smärtade vid palpation av käklederna. Sammanfattningsvis kan sägas att det är en något högre prevalens av subjektiva symptom hos ungdomar än bland barn (*Nilner & Lassing* 1981).

INTRODUCTION

To find out the prevalence of and to understand the development of functional disturbances and diseases in the masticatory system, epidemiological studies in different age groups are required. Investigations carried out amongst adults point to signs of such disorders in at least 50% of the adult population. For a review, see *Helkimo* 1976.

There have been few epidemiological studies made of young adults; *Ingervall &*

Hedegård (1974) found in their questionnaire survey of 287 18-year old males, only 7.5% with frequently recurring headaches, and 4.3% who were aware of grinding and 7.2% clenching.

Mohlin, Carlsson, Friling & Hedegård (1976) found in an investigation of 19 year old males 28% with "symptoms of dysfunction" of the masticatory system. *Solberg, Woo & Houston* (1979) observed in their study of 19-25 year

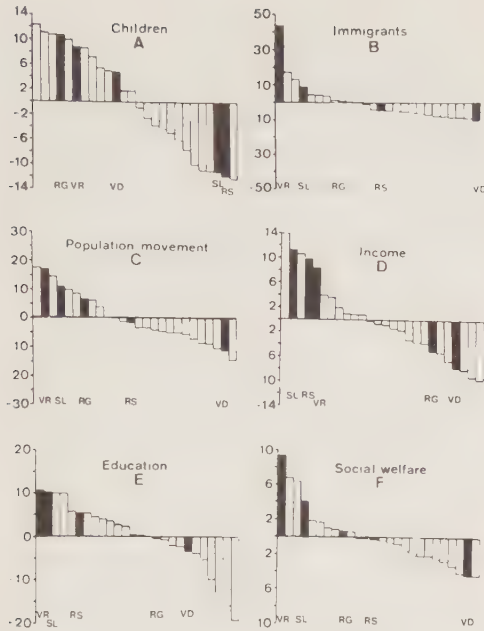


Fig. 1 a-f. Social profile of the school districts within Malmö 1976.

e) early school leavers aged 16-59/the total number of persons aged 16-59

f) persons on social welfare/the population total.

A detailed description has already been published (Nilner & Lassing 1981).

METHOD

The teenagers from the 15-18 age range, were interviewed with regard to symptoms indicating functional disturbances and diseases in the masticatory system. Clinical examination of the masticatory system was carried out in accordance with a specially devised examination form. A more detailed account of the interview and the clinical examination has been published (Nilner & Lassing 1981).

STATISTICAL ANALYSIS

Data from the examination forms were punched and processed at the Computing Centre, University of Lund. The programme used was Statistical Package for the Social Sciences. (Nie, Hull, Jenkins, Steinbrenner & Bent 1975).

RESULTS

INTERVIEW

Forty-one per cent (41%) of the 15-18 year olds claimed symptoms, Fig. 2. Troublesome aches in the temples and head occurred in 20%. Twenty-eight per cent (28%) said that they either had, or previously had been conscious of, clicking sounds in the temporomandibular joints.

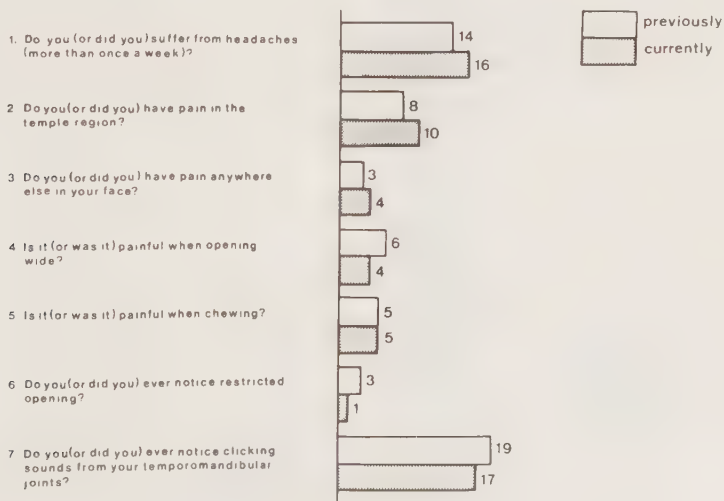


Fig. 2. Symptoms in the masticatory system expressed as a percentage of 440 schoolchildren aged 15-18.

Parafunctions were noted by 74%, their distribution is shown in Fig. 3. Seventeen per cent (17%) of the children stated that they had received a heavy blow to the face. Twenty-five per cent (25%) had undergone orthodontic treatment and 5% were receiving such treatment at the time of the survey.

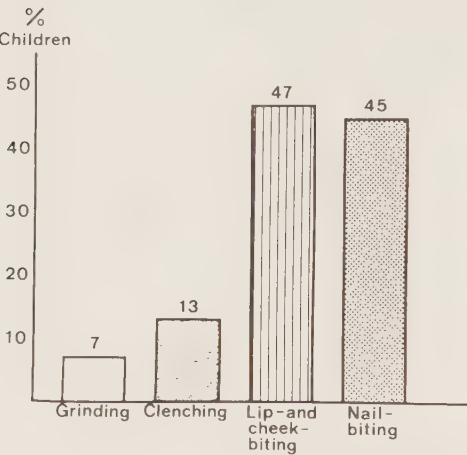


Fig. 3. The frequency of parafunctions in 309 schoolchildren expressed as percentage.

CLINICAL EXAMINATION

The intermaxillary relationship showed neutral relations in 89%, distal in 7% and mesial in 4%. There was no individual with marked lower jaw asymmetry, and no individual who had missed more than two teeth per quadrant. Fourteen per cent (14%) had crossbite, three per cent (3%) scissors bite and one per cent (1%) inversion. Six per cent (6%) had open bite and twenty per cent (20%) deep bite.

Table 3. The percentage of children with occlusal interferences in RP and with mediotrusion interferences. n = 309.

Occlusal interferences	Localisation			Total
	Only right side	Only left side	Both sides	
Occlusal interferences in RP	30	42	11	83
Mediotrusion interferences	5	6	66	77

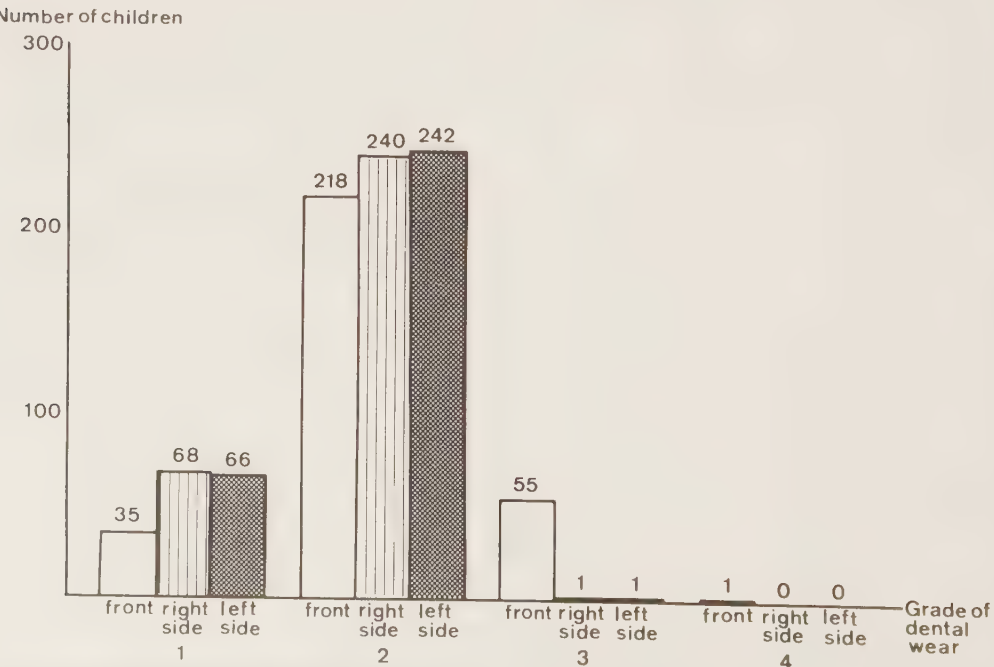


Fig. 4. The total number of children in the age range 15-18 years with dental wear of grade 1-4 and its localization.

Occlusal interferences in the terminal hinge movement of the lower jaw occurred in 83% and mediotrusion interferences in 77%. The distribution of interferences is illustrated in Table 3. Cuspid rise was found in 58% of the children examined. The degree of dental wear is shown in Fig. 4. Most of the youngsters had dental wear grade 2. More than half the young people (55%) exhibited muscles which were tender on palpation. The posterior belly of the digastric muscle (26%), the lateral pterygoid muscle (27%) and the attachment of the temporal muscle (20%) showed the highest frequencies (Fig. 5). Thirty-four per cent (34%) stated that they experienced pain in the temporomandibular joints on palpation, and almost as often from the posterior (22%) as lateral (23%). Pain in the temporomandibular region on passive opening of the mouth was recorded in 10% of the sample, and in four individuals, restricted movement of the temporomandibular joints was observed.

Clicking sounds were noticed in 14%. The clicking was unilateral in 10% and bilateral in 4%. Crepitation was found in two cases.

Irregular opening movements and/or deviation when the mouth was open wide, was recorded in 50%. For other deviations in connection with movements of the lower jaw, see Table 4. In most cases the deviations occurred to the left.

The average value for maximum active opening in the 15-18 age range was 56.2 mm

(S.D. 6.0 mm). The mean value in each of the age groups is shown in Table 5.

Taken as a whole, 77% of the teenagers examined had one to three of the following signs: temporomandibular joint sounds, decreased capacity to open wide (< 40 mm), temporomandibular joints and muscles tender on palpation, Table 6.

DISCUSSION

This survey is a continuation of the study carried out among 7-14 year olds in Malmö (Nilner & Lassing 1981). The selection of 18 as the upper age limit was based on the fact that the stomatognathic system has at that age practically reached full development (Carlsson & Öberg 1979).

To reduce the drop-out rate to a minimum, the investigation was conducted at the school clinics, where the children could easily be

Table 4. The percentage of children with deviation of the chin when opening wide, at protrusion or with asymmetrical lateral mobility capacity. $n = 309$.

Mandibular movements	Deviation to		Total
	Right	Left	
Maximal opening	1	32	33
Protrusion	11	23	34
Lateral movement capacity largest to	5	13	18

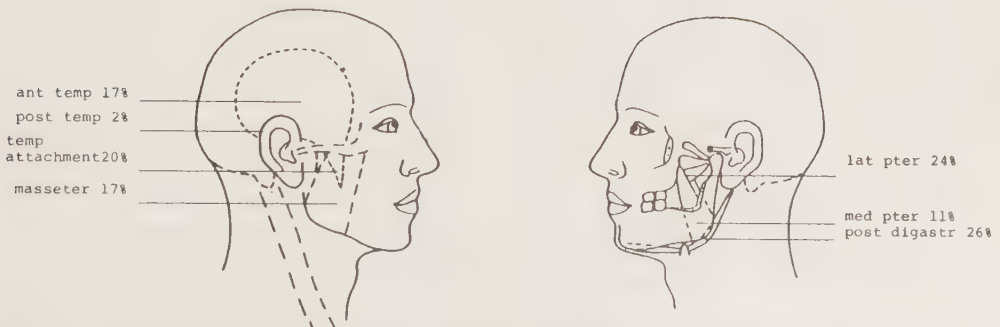


Fig. 5. The occurrence of muscles tender on palpation expressed as a percentage. $n = 309$.

contacted. Drop-out among 17 year olds was higher than among 15 and 16 year olds, whilst more than half the absenteeism was accounted for by the 18 year olds. Many of the 17 and 18 year olds had left school, moved or started to work, which rendered their participation in the examination more difficult.

As far as the socioeconomic structure is concerned, both incomes and level of educational achievement were lower than the average for the city of Malmö. Seen in the context of

the study by *Agerberg, Carlsson & Hällqvist* (1977) it is probable that the total number of symptoms recorded among the teenagers examined in this study is more prevalent than in an average socioeconomic grouping.

The investigation was conducted as a combined interview and clinical examination. The advantages and disadvantages of these methods have been discussed previously (*Nilner & Lassing* 1981).

The percentage of symptoms found in this

Table 5. The average values and standard deviation of maximal opening capacity in the age range 15-18 years. n = 309.

Age (years)	Opening capacity (mm)					
	Boys		Girls		Total	
	mean	S.D.	mean	S.D.	mean	S.D.
15	57.7	6.8	54.2	4.7	56.1	6.2
16	57.9	5.0	55.5	5.6	56.5	5.4
17	56.6	7.0	55.3	5.5	55.9	6.2
18	56.8	8.2	55.5	4.5	56.0	6.3

Table 6. The number of children with one, two or three signs. n = 309.

		Number of individuals	%
TMJ-sounds	C	17	
Decreased range of opening of the mouth < 40 mm	DO	0	
Temporomandibular joints tender on palpation	JP	23	
Masticatory musculature tender on palpation	MP	77	
		117	37.9
	C+DO	0	
	C+JP	1	
	C+MP	12	
	DO+JP	0	
	DO+MP	0	
	JP+MP	63	
		76	24.6
	C+DO+JP	0	
	C+DO+MP	0	
	C+JP+MP	16	
	DO+JP+MP	0	
		16	5.2
	C+DO+JP+MP	0	67.7

age range (41%) was somewhat higher than the 36% recorded in the study of *Nilner & Lassing* (1981) of 7-14 year olds.

Headaches among the age groups examined here occurred in 16%. Investigations among adults have presented figures ranging from 12.5% to 24% (*Helkimo* 1974, *Hansson & Nilner* 1975, *Agerberg & Carlsson* 1977, *Solberg et al.* 1979). It would therefore appear as if young people aged 15-18 suffer from recurring headaches to the same extent as adults.

Temporomandibular joint sounds, in form of clicking, were present according to the interview in 17%, and in the clinical examination 14%. The discrepancy can be explained by the intermittent nature of clicking. The presence of clicking in the 7-14 age range was 13% and 8% respectively (*Nilner & Lassing* 1981). Higher values were found in the adult material: 35% *Helkimo* (1974), 39% *Agerberg & Carlsson* (1972), 40% *Lysell* (1977), 44% *Hansson & Nilner* (1975), *Solberg et al.* (1979) who studied young adults, found clicking in 16.6% and *Heløe & Heløe* (1977) in 19%. The prevalence of clicking sounds in children, teenagers, young people and adults, confirm the findings of the examinations from autopsy materials. Deviations in form occur in the temporomandibular joints as early as young adulthood, and are found in increasing quantities higher up the age scale (*Öberg, Carlsson & Fajers* 1971, *Hansson & Öberg* 1977, *Hansson, Solberg, Penn & Öberg* 1979). Thus the rates of clicking are more evident with increasing age, but should not be seen entirely as a sign of ageing: attention should be paid to these symptoms when they occur in the younger age ranges. Other causes of temporomandibular sounds, such as caput-disc-displacements and muscular incoordinations have been suggested (*Laskin* 1969, *Wilkes* 1978, *Farrar & McCarty* 1979, *Isberg-Holm* 1980).

The presence of oral parafunctions (74%) in the age range under study corresponds closely to the results shown in 7-14 year olds (77%) (*Nilner & Lassing* 1981). One remarkable finding was that grinding and clenching occurred

almost twice as often among 7-14 year olds as among the 15-18 age group. The study of the 7-14 age range revealed similar differences between the youngest (7-10) and oldest (11-14). The actual frequency of parafunctions is very difficult to determine. The individual is not always aware of his habits, and a clinical examination does not always reveal them, as they sometimes occur intermittently. Nevertheless, it can be stated that nailbiting, and biting on the lips and cheeks, are common among children and teenagers, whilst grinding and clenching appear to decrease between the childhood and teenage years, among the sample studied in Malmö. Occlusal interferences in retruded position (RP) were present in 83% of the children examined. Unilateral interferences were the most usual; only 11% of the children had bilateral occlusal interferences. *Nilner & Lassing* (1981) discovered approximately the same proportions (13% bilateral, 63% unilateral) in children aged 7-14. *Siebert* (1975) found occlusal interferences in more than 80% of 212 12-16 year olds. Mediotrusion interferences were also frequent (77%). *Ingervall* (1972) noted among 11 year olds mediotrusion contacts in 88% when examining a 3 mm slide.

Cuspid rise was found in 58%. *Scaife & Holt* (1969) found corresponding figures for Angle class I and II among young adults.

Dental wear was mostly of grade 1 (dental wear of the enamel only). One startling result was that there were 55 children with grade 2, i.e. dental wear of the enamel and dentine. One child had grade 3, i.e. dental wear of up to 1/3 of the length of the crown or noticeable wear on the facial or lingual surface. Dental wear greater than grade 2 should be viewed as serious, and ought to lead to examination and treatment.

Regarding tenderness on palpation of the temporomandibular muscles and joints, the percentages were high, if not so high as in the examination carried out among the 7-14 age range by *Nilner & Lassing* (1981). Tenderness on palpation of the lateral pterygoid muscle

was, however, more common in the age range 15–18 than among 7–14 year olds.

Deviations of the chin during the various mandibular movements occurred more frequently among the higher age group (15–18) than in the previously investigated younger group (7–14) (Nilner & Lassing 1981). One notable finding was that deviations in this group also occurred most frequently to the left. *Grosfeld & Czarnecka* (1977) have discussed these left-biased deviations in relation to physiological functional asymmetry, e.g. right-handedness. The capacity to open wide among 15, 16, 17 and 18 year olds was equal, approximately 55 mm as compared with approximately 51 mm in 7–14 year olds. Earlier investigations (*Nevakari* 1960, *Agerberg* 1974, *Ingervall* 1970, 1971, *Landtving* 1978) have also shown that the ability to open wide increases from early childhood up to the 15–20 age range, only to decrease with age (*Lignell & Ransjö* 1967, *Agerberg* 1974).

A comparison between the children examined in the first study (*Nilner & Lassing* 1981) and the teenagers examined in this survey, show a higher prevalence of symptoms among the older children. Development of more serious symptoms is apparent with increasing age. A study of the differences and the relations between variables for the different age range are to be reported in a later study.

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RELATIONSHIPS BETWEEN ORAL PARAFUNCTIONS
AND FUNCTIONAL DISTURBANCES AND DISEASES OF
THE STOMATOGNATHIC SYSTEM AMONG CHILDREN
AGED 7 - 14

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Running head: Functional disturbances in
7-14 year olds

Nilner, M.

Relationships between oral parafunctions and functional disturbances and diseases of the stomatognathic system among children aged 7-14. Acta Odontol. Scand. 1983:41

Data from an interview and clinical examination in a study of 440 randomly selected schoolchildren were analysed with regard to relationships between signs and symptoms of functional disturbances and diseases in the stomatognathic system. A correlation was found between reported clicking sounds from the temporomandibular joint (TMJ) and pain when opening the mouth wide. Children who had been treated orthodontically or who were under such treatment did not differ from other children in the frequency of signs and symptoms. Correlations were found between recurrent headaches and tenderness in TMJ and TMJ muscles. Reported pain in the temple region was also correlated to tenderness in the TMJ and TMJ muscles. Further correlations were found between recurrent headaches and oral parafunctions such as lip-cheek-biting and nailbiting as well as between nailbiting, tooth clenching, toothgrinding and frontal dental wear. Children who reported oral parafunctions had more frequently interferences in RP and tenderness in TMJ muscles. There were correlations between irregular movements of the lower jaw and interferences in RP as well as mediotrusion interferences. Finally a strong correlation was found between tenderness of the TMJ (laterally and posteriorly) and tenderness of the TMJ muscles.

Key words: Temporomandibular joint syndrome; epidemiology;
child

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INTRODUCTION

Epidemiological studies have revealed that symptoms of functional disturbances and diseases of the stomatognathic system are common among both children and adults. Grosfeld and Czarnecka (14) recorded a frequency of more than 50% of "musculo-articular disorders" among children aged 6-8 and 13-15, 56.4% among the 6-8 year olds and 67.7% among the 13-15. Thirtysix per cent of children aged 7-14 (29) and 41% of teenagers aged 15-18 (28) reported symptoms. In a review of epidemiological studies, Helkimo (21) concluded that at least half of the adult population in Sweden shows signs of diseases in the mandibular joints and muscles. A great proportion of these signs, however, are slight and not even noticed by the individuals and thus of little significance when estimating the need for treatment. A difference in the frequency of certain symptoms such as headaches, clicking and crepitation seems to exist between adults and children (11, 21, 28, 29). The purpose of this investigation was therefore to investigate the condition of the stomatognathic system among children between 7 and 14 years of age, and to analyse the relationships between signs and symptoms and oral parafunctions, occlusal interferences and malocclusions.

MATERIAL AND METHODS

Four hundred and forty school children between the ages of 7-14 were examined at school dental clinics in Malmö during autumn 1976 and spring 1977 (Table 1). The socioeconomic structure of the parents of those examined was above the average in terms of income, but somewhat lower than the average in terms of education. The children were interviewed regarding symptoms in the stomatognathic system and a clinical examination was conducted. This examination included the temporomandibular joint (TMJ) and muscles, mandibular mobility, joint sounds, mandibular deviation and degree of dental wear. A detailed description of the material and methods used has been given previously (29).

The chi-square test was used for an analysis of correla-

tions between variables and differences between groups. The following levels of significance were used and denoted N.S. (not significant) $p \geq 0.05$, * $0.01 \leq p < 0.05$, ** $0.001 \leq p < 0.01$ and *** $p < 0.001$.

RESULTS

Correlations between symptoms

The relationships between the different answers to the interview are illustrated in Table 2.

Correlations between symptoms, signs and clinical findings

Correlations found between symptoms reported in the interview and tenderness on palpation of TMJ and TMJ muscles are shown in Tables 3 and 4. A significant correlation was found between reported TMJ clicking and deviation on opening the mouth wide, tenderness to palpation of the attachment of the temporal muscle and the TMJ laterally ($p < 0.05$).

Children who had been treated orthodontically or who were under such treatment did not differ from other children in the frequency of signs and symptoms. The children who had received orthodontic treatment showed a higher frequency of cuspid rise ($p < 0.01$) and a lower degree of dental wear in the premolar- and molarregion ($p < 0.01$).

Occlusal interferences in RP were found with similar frequency among children who had received orthodontic treatment as among those who had not.

Several statistically significant correlations were found between oral parafunctions and symptoms, signs and clinical findings in the stomatognathic system (Table 5). Those who were aware of grinding reported that they clenched their teeth ($p < 0.01$) and that they were lip-cheek-biters and nailbiters ($p < 0.05$). The occurrence of oral parafunctions as estimated by the interview was more frequent among children with interferences in RP and among children tender to palpation in the TMJ muscles ($p < 0.05$).

Correlations between clinical findings

Children who had unilateral interferences in RP (vertical difference RP-IP) showed asymmetrical lateral movement capacity ($p < 0.001$) and among children with bilateral interferences in RP asymmetrical lateral movement capacity were found ($p < 0.05$). There was a correlation between mediotrusion interferences and lateral deviation of the chin on maximal mouth opening ($p < 0.01$) and irregular movements of the lower jaw ($p < 0.05$).

Dental wear in the lateral sections was more pronounced in bites with mediotrusion interferences than in bites without ($p < 0.01$). Children with mesial and distal intermaxillary relationships had more often severe dental wear in the lateral sections than children with neutral relation ($p < 0.05$).

There was a strong correlation between tenderness to palpation of the TMJ (laterally and posteriorly) and tenderness to palpation of the TMJ muscles ($p < 0.01$). The masseter muscle was tender to palpation in children with pain on passive mouth opening ($p < 0.001$), with lateral deviation of the chin on maximal mouth opening ($p < 0.001$), and with lateral deviation of the lower jaw on protrusion ($p < 0.01$). Muscle tenderness to palpation of the lateral pterygoid muscle occurred more frequently in children with lateral deviation on maximal mouth opening ($p < 0.001$).

Tenderness to palpation laterally over the TMJ was found more frequently in children who showed lateral deviations on maximal mouth opening and protrusion ($p < 0.01$).

DISCUSSION

The study of the function and the state of the stomatognathic system of 7-14 year old children was done to provide means to estimate the need of treatment of functional disturbances and diseases in the stomatognathic system in children of those ages. Furthermore the epidemiological data can be used to elucidate the aetiology of these disorders.

There is always a problem concerning accuracy and precision in clinical examinations. This problem is enhanced when more

than one examiner is involved in the clinical examination. If, however, the number of investigators is low and a standardized technique is applied the inter-observer variability will be acceptable (9). The present study is based on findings made by two investigators (29) and since the examination methods were standardized and trained, it is considered justifiable to draw conclusions based on the data from both the interview and clinical examination.

Many investigations among adults have revealed a correlation between headaches and muscle tenderness (2, 3, 13, 17, 19, 24, 25, 34). The results suggest that annoying, frequently recurring headaches might be caused by disorders in the muscles of the stomatognathic system. The present findings of recurring, troublesome headaches and pains in the temples, were significantly correlated with tenderness to palpation of the TMJ and TMJ muscles, as well as with discomfort and difficulty in moving the jaw and therefore confirm previous results. Difficulties in opening the mouth wide were also associated with a history of trauma to the face. Reports from patients in clinical studies imply that acute trauma is a fairly common cause of symptoms in the stomatognathic system (2, 8, 10).

Temporomandibular joint sounds in the form of clicking are associated with disturbances in the movements of the mandible and are probably caused by structural changes of the joint components, subluxation (caput-disk displacement) and/or muscular incoordination (8, 15, 23, 27, 35). Clicking sounds occurred less frequently in children than has been reported in adults (1, 16, 17, 20, 22, 34). It has been shown that deviation in form of the TMJ among adults increase in extent and frequency with increasing age (15, 18, 30). The increasing frequency of clicking sounds with age may therefore signify deviation in form in addition to subluxation and muscular incoordination. It is notable that as many as 32% of the children demonstrated irregular opening movements.

Oral parafunctions were common in this study and were correlated with symptoms in the stomatognathic system including headaches. Associations were found between lip-cheek-biting and headaches, and between lip-cheek-biting, nailbiting and

aches in the temple region. Geering-Gaerny & Rakosi (12) also found a high frequency of lip- and cheek-biting in patients with "initial symptoms of functional disturbances in the masticatory system" compared to a control group.

The results from this study of 7-14 year old children also revealed a strong correlation between tenderness to palpation of the temporomandibular joint and of the TMJ muscles. This lends support to the view that both the joints and musculature are commonly involved simultaneously.

Several different causes may be considered to explain disturbance of mandibular movement patterns and movement capacity. It can be caused by diseases in the TMJ and TMJ muscles, changes in the neuromuscular functional pattern, and on an unfavourable form-function relationship in the temporomandibular joint (7). Occlusal interferences resulting in grinding and muscle tenderness can be one explanation as they were correlated to disturbances of the movement pattern (33). Moreover it is possible that these disturbances of movements are caused directly by a neuromuscular influence aimed at avoiding certain movements (4). Beyron (5, 6) has reported longitudinal investigations on the disadvantageous effect on movement pattern of interferences, and the normalization following elimination of the interferences. Against this background occlusal interferences in association with clinical signs in children ought to be eliminated. Children with mediotrusion interferences often had more dental wear in the lateral sections than others, which demonstrates the unfavourable influence of these interferences on the function of the stomatognathic system previously reported by Ramfjord (31, 32).

The results of this study show that recurrent headaches in children often are associated with occlusal interferences, oral parafunctions and tenderness of TMJ and TMJ muscles. Reported clickings were associated with unilateral interferences in RP. An examination of the stomatognathic system should therefore be carried out in all cases with juvenile recurrent headaches.

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Table 1. The 440 children examined according to clinic of attendance (LA, RG) age and sex.

Age (years)	Boys		Girls		Total
	LA	RG	LA	RG	
7	18	21	14	17	70
8	19	11	12	12	52
9	24	0	23	0	47
10	23	0	24	0	47
11	8	16	16	19	59
12	10	16	14	7	47
13	0	31	0	31	62
14	0	27	0	29	56

Table 2. Level of significance of correlations between different answers to the interview, in 440 children.

Interview answers	Headaches	Pain in the temple region	Clicking sounds from the temporomandibular joints	History of heavy trauma to the face
Pain when opening the mouth wide	* * *	* *	* *	N.S.
Restricted mouth opening	N.S.	* * *	N.S.	* *

Table 3. Level of significance of correlations between symptoms reported in the interview and tenderness on palpation of temporomandibular joint and TMJ muscles, in 440 children.

Location of palpation and tenderness	Anterior temporal muscle		Posterior temporal muscle		Attachment temporal muscle		Masseter muscle		Medial pterygoid muscle		Lateral pterygoid muscle		Posterior belly of digastric muscle		Lateral aspect of the TMJ		Posterior aspect of the TMJ	
	Symptoms reported in the interview																	
Symptoms reported in the interview	Restricted mouth opening	*	*	*	*	*	*	*	*	*	N.S.	N.S.	N.S.	*	*	*	*	*
	Pain when opening the mouth wide	*	*	N.S.	N.S.	N.S.	N.S.	*	*	*	*	*	*	*	N.S.	*	*	*
	Pain in the temple region	*	*	*	*	*	*	*	*	*	N.S.	N.S.	*	*	*	*	*	*
	Recurrent headaches	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 4. Relationship between recurrent headaches and tenderness to palpation in the anterior temporal muscle.

Anterior temporal muscle		Recurrent headaches		
		NO	YES	
Recurrent headaches	NO	297	80	377
	YES	28	35	63
		325	115	440

Table 5. Level of significance of correlations between parafunctions, symptoms and signs in the stomatognathic system in 440 children.

Symptoms and signs	Tooth grinding	Tooth clenching	Lip-cheek-biting	Nail-biting	Thumb-sucking
Recurrent headaches	N.S.	N.S.	* * *	*	N.S.
Pain in the temple region	*	*	* * *	* *	N.S.
Tenderness on palpation of the attachment of the temporal muscle	* *	* *	N.S.	N.S.	N.S.
Frontal dental wear	* * *	* *	N.S.	* *	---
Lateral dental wear	* *	N.S.	N.S.	N.S.	* * *
Occlusal interferences in RP	*	N.S.	N.S.	N.S.	---

RELATIONSHIPS BETWEEN ORAL PARAFUNCTIONS AND
FUNCTIONAL DISTURBANCES AND DISEASES IN THE
STOMATOGNATHIC SYSTEM AMONG 15-18 YEAR OLDS

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Running head: Functional disturbances in
15-18 year olds

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Relationships between oral parafunctions and functional disturbances and diseases in the stomatognathic system among 15-18 year olds. Acta Odontol. Scand. 1983:41

An interview and a clinical examination of signs and symptoms of functional disturbances and diseases in the stomatognathic system were performed on 309 adolescents in the age 15-18. Relationships and differences between data from this investigation were analysed.

Statistically significant correlations were found between headaches, bruxism and tenderness to palpation of the attachment of the temporal muscle. There were also correlations between occlusal interferences in the retruded position (RP) and clickings as well as between mediotrusion interferences and symptoms. The occlusal interferences were correlated to tenderness to palpation of the TMJ and TMJ muscles.

Young people with distal occlusal relation were more frequently conscious of symptoms from the stomatognathic system than those with neutral or mesial occlusal relation. Deep bite was correlated to clenching and frontal dental wear.

Key words: Temporomandibular joint syndrome; epidemiology; adolescence.

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INTRODUCTION

Symptoms and signs of functional disorders and diseases in the stomatognathic system have been reported to be common among young children and adolescents (5,8,19,20,21). Symptoms for example have been experienced in about 40% of the examined subjects although mostly of rather mild character. The most prevalent signs found have been tenderness on palpation of temporomandibular joint (TMJ) muscles and temporomandibular joints and deviations in movements of the lower jaw. In an investigation including interview and clinical examination of the stomatognathic system of 309 15-18 year olds recurrent headaches and clickings were found to be the most commonly reported symptoms (16% and 17%, respectively). Grinding was in this group reported in 7% and clenching in 13% (19).

In adults the etiology of functional disorders and diseases in the stomatognathic system is generally suggested to be multifactorial (4,16,23). Psychological, local and general somatic factors seem to be of importance. For the evaluation of the significance of these factors in the population, epidemiological studies are required.

The aim of this investigation was to correlate the data collected from interview and clinical examination of the above mentioned study of 15-18 age group and to evaluate possible etiological factors of functional disorders and diseases in the stomatognathic system in this age group.

MATERIAL AND METHODS

A random sample of 405 young people in the age group 15-18 were selected from the school dental clinics in Malmö in 1978. Of these 309 were examined, Table 1. This group and its socioeconomic structure has previously been described (19) and an detailed account been given of the interview and clinical examination (21). On the whole the socioeconomic structure of the examined group of teenagers was somewhat below average for the city of Malmö. The adolescents were interviewed for symptoms

and parafunctions in the stomatognathic system. The clinical examination included the temporomandibular joints, TMJ muscles, occlusion and mandibular movement.

The chi-square test was used for analysis of correlations and differences between groups for the recorded variables. The following levels of significance were used and are denoted by N.S. (not significant) $p \geq 0.05$, $*0.01 \leq p < 0.05$, $**0.001 \leq p < 0.01$ and $*** p < 0.001$.

RESULTS

Correlations between symptoms, signs and occlusal findings

Forty-one per cent reported one or more symptoms such as headaches, pain in the temple region, pain elsewhere in the face, difficulties and pain when opening the mouth wide, pain during chewing and clicking from the TMJ. Among those who reported symptoms, mediotrusion interferences ($p < 0.01$), clickings audible by stethoscope and tender muscles were recorded more frequently ($p < 0.001$) than among those who did not report symptoms. This was also the case for the frequency of irregular opening movements which were also significantly correlated to current and previous clickings ($p < 0.001$) and pain on opening the mouth wide ($p < 0.01$). Reported previous clickings were significantly correlated to tenderness in the masseter and the lateral pterygoid muscle as well as pain on passive opening ($p < 0.05$). Individuals with distal occlusal relation were more frequently conscious of symptoms from the stomatognathic system ($p < 0.01$).

The relationships between current and previous headaches, temple aches and parafunctions and tenderness on palpation are presented in Table 2. Correlations were observed between clenching and deep bite ($p < 0.01$), between lip-cheek biting and interferences in RP as well as tenderness on palpation over the masseter muscle ($p < 0.01$).

Individuals who had undergone orthodontic treatment showed no difference in the number of occlusal interferences in the retruded position (RP), compared to those who had not undergone such treatment. The subjects with reported current clickings had interferences in RP more often than those without

clickings ($p < 0.05$).

Correlations between signs and occlusal findings

Tenderness on palpation over the temporomandibular joint laterally and posteriorly and tenderness on palpation of the following muscles: temporal, masseter, lateral pterygoid and posterior digastric were significantly correlated ($p < 0.01$ and $p < 0.001$). Among those who reported pain on passive opening tenderness to palpation was found of the masseter muscle, the posterior belly of digastric muscle and the lateral aspect of the temporomandibular joint ($p < 0.001$). In the adolescents deviations on opening the mouth wide and assymetrical lateral mobility were correlated to deviations in protrusive movements ($p < 0.01$).

Adolescents with deep bite had more frequently frontal dental wear ($p < 0.01$). The adolescents with distal occlusal relation showed asymmetrical lateral mobility and irregular movements when opening the mouth wide more frequently than those with neutral or mesial occlusal relation ($p < 0.01$).

Correlations were found between interferences in RP and deviation at maximal mouth opening ($p < 0.01$), tenderness to palpation of the TMJ laterally ($p < 0.05$), and unilateral interferences in RP and irregular movements and deviations at maximal opening ($p < 0.01$). There was also a statistically significant correlation between dental wear in the lateral sections and mediotrusion interferences. Mediotrusion interferences were correlated to tenderness to palpation of the TMJ laterally ($p < 0.001$). The masseter muscle and the attachment of the temporal muscle were tender on palpation more often in adolescents with mediotrusion interferences than in young people without ($p < 0.05$). Mediotrusion interferences and pain on passive opening showed also a statistically significant correlation ($p < 0.001$).

DISCUSSION

This study is a continuation of an earlier prevalence study of functional disturbances and diseases in the stomatognathic sys-

tem of the same age group (19). It was undertaken in order to estimate the need of treatment and to elucidate the etiology of these disorders among adolescents.

Headaches and pain in the temple region were correlated with tenderness on palpation of the TMJ and TMJ muscles. Similar results have been obtained from 7-14 year olds (20) and from adults (1,2,7,10,11,12,13,14,17,24). Bruxism seems to play an important role in the etiology of muscle tenderness and recurrent headaches, since there were several strong correlations between clenching, grinding, muscle tenderness and headaches. The results of this study indicates that teenagers who suffer from headaches and without any apparent medical cause should be given opportunity to an examination of the stomatognathic system.

The significance of occlusal interferences as a trigger for oral parafunctions, their influence on the muscles and TMJ and on the function of the stomatognathic system in general, have been discussed by Carlsson (3). In his review it is stated that there is no absolute relationship between interferences and symptoms and signs. Unilateral as well as bilateral interferences in RP as well as mediotrusion interferences among the young people in this study, showed statistically significant correlations to symptoms, signs and oral parafunctions. These findings suggest that occlusal interferences are of importance as etiological factors in functional disturbances and stress the need of occlusal treatment in young people with occlusal interferences, combined with symptoms, signs and/or oral parafunctions.

Temporomandibular joint clickings are considered to be associated with disc displacement (6,15,25) often associated with muscular incoordination and sometimes deviations in form of the joint components (9,18). That occlusal interferences could be an etiological factor of clickings was indicated in this study by the correlation found between clickings and unilateral interferences in RP. In an experimental study Randow et al (22) showed that occlusal interferences could cause TMJ clickings. These results indicate that attention should be paid to occlusal interferences as etiological factors to

clickings.

The young people with distal occlusal relation reported symptoms and moreover demonstrated a higher frequency of irregular mandibular opening movements and asymmetrical lateral mobility than the others. In their investigation of school-children, Grosfeld and Czarnecka (8) found a relationship between "malocclusion and musculoarticular disorders" in the age group 13-15 years. They stated that "malocclusion" was necessary for a certain length of time in order to have an effect on the stomatognathic system. The results of this study and the study of 7-14 year olds (19) show that the detrimental effect of distal occlusal relation is not found until adolescence. Distal occlusal relation seems to be an etiological factor of importance in the development of symptoms and signs in the stomatognathic system. Functional examination of the stomatognathic system in adolescents with distal occlusal relations ought to be performed as this occlusal relation can be a risk factor for the development of functional disorders and diseases in the stomatognathic system.

It can be concluded that the occlusal factors play an important role in the etiology and development of functional disturbances and diseases including headaches. Such occlusal factors are interferences in RP, mediotrusion interferences, distal relation and deep bite.

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Table 1. Age and sex distributions in a group of 309
15-18 year olds.

Age \ Sex	Boys	Girls	Total
15	51	41	92
16	37	48	85
17	35	40	75
18	24	33	57
	147	162	309

Table 2. Correlations investigated between head- and temple aches, oral parafunctions and clinical findings

Head- and temple ache Parafunctions and clinical findings	Grinding		Clenching		Tenderness to palpation of:		the anterior temporal muscle		the attachment of the temporal muscle		posterior belly of the digastric muscle		lateral aspect of the TMJ		posterior aspect of the TMJ	
Current headaches	**		***	***	***	*	*	**	*	**	*	(N.S.)	*		(N.S.)	
Previous headaches	**		***	***	**	(N.S.)	(N.S.)	(N.S.)	(N.S.)	(N.S.)	(N.S.)	*				*
Current pain in the temple region	(N.S.)		*	*	(N.S.)	(N.S.)	(N.S.)	*	(N.S.)	*	(N.S.)	**				**
Previous pain in the temple region	(N.S.)		***	***	(N.S.)	(N.S.)	(N.S.)	(N.S.)	(N.S.)	(N.S.)	(N.S.)	*				*

DISTRIBUTION BY AGE AND SEX OF FUNCTIONAL DISTURBANCES AND
DISEASES OF THE STOMATOGNATHIC SYSTEM IN 7 - 18 YEAR OLDS

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Key words: Temporomandibular joint syndrome, epidemiology,
child, adolescence, headache

Abstract

The investigation consisted of 749 randomly selected subjects between 7-18 years of age. The subjects were interviewed for symptoms and oral parafunctions and examined clinically for occlusal interferences, malocclusions and signs of functional disturbances and diseases in the stomatognathic system. The group with one or more symptoms indicated no sex difference but the symptoms showed a gradual increase with age. Recurrent headaches were evenly distributed between the ages, but more commonly reported among girls in the age range between 7-14 years. Clickings increased by age and some sex differences were found in the age distribution.

Grinding and clenching showed a negative correlation with age. Boys reported clenching more often than girls between 7-14 years of age.

Lip-cheek-biting and nailbiting were frequently reported in all ages. Girls in the age group of 15-18 years reported lip-cheek-biting more often than boys of the same age group; who on the other hand reported nailbiting more often. A correlation was found between thumbsucking and anterior open bite.

Sammanfattning.

Studien omfattade 749 slumpmässigt utvalda barn och ungdomar i åldern 7-18 år. Individerna intervjuades och undersöktes kliniskt avseende orala parafunktioner, ocklusala interferenser, malockklusioner och symptom på funktionella störningar och sjukdomar i tuggsystemet. Vad gäller förekomsten av åtminstone ett subjektivt symptom förelåg ingen könsskillnad men prevalensen ökade svagt med åldern. Prevalensen av återkommande huvudvärk var ungefär lika stor i dessa åldrar. Huvudvärk rapporterades oftare av flickor i åldern 7-14 år. Prevalensen av knäppningar ökade svagt med åldern och i vissa åldrar förelåg frekvensskillnader mellan könen.

Tandgnissling och tandpressning var negativt korrelerade till ålder. Pojkar rapporterade oftare än flickor tandpressning i åldern 7-14 år. Läpp-kind-bitning och nagelbitning förekom ofta i dessa åldrar. Flickor i åldern 15-18 år uppgav oftare att de var läpp-kind-bitare, medan pojkarna å andra sidan oftare sade sig vara nagelbitare. Det förelåg ett statistiskt samband mellan tumsugning och öppet bett.

INTRODUCTION

One of the first studies of epidemiologic character concerning functional diseases and disturbances in the stomatognathic system of children and adolescents was performed by Grosfeld and Czarnecka (1977). Clinical signs were thereby reported with a frequency of 56.4%, in the age group between 6-8 years, and 67.6% in the 13-14 year age group. However, no prevalence figure for symptoms were reported.

Some epidemiologic studies concerning children and adolescents have been presented recently. Subjective symptoms were found in 36% of children between 7-14 years of age (Nilner & Lassing 1981) and 41% among adolescents between 15-18 years of age (Nilner 1981). Egermark-Eriksson, Carlsson and Ingervall (1981) found symptoms in 16, 17 and 25% respectively in the three age groups 7, 11 and 15. These studies thus showed a higher prevalence of symptoms in the oldest age group than in the youngest age group.

The prevalence of signs of functional disturbances and diseases in the above mentioned studies is high (30-72%) and similar to the prevalence figures of signs presented among adults (20-88%, Helkimo 1979).

So far there is no study, concerning the distribution of symptoms, signs and parafunctions in the stomatognathic system in consecutive ages in children and adolescents. The aim of this investigation was therefore to study these aspects in relation to sex and age between 7 and 18 years of age.

MATERIAL AND METHODS

The investigation consisted of 749 randomly selected subjects between 7-18 years of age (Table 1). The subjects were interviewed for symptoms and oral parafunctions and examined clinically for occlusal interferences, malocclusions and symptoms and signs of functional disturbances and diseases in the stomatognathic system. The interview and clinical examination methods as well as the subjects have been described in detail earlier (Nilner 1981, Nilner & Lassing 1981).

The interview contained questions concerning symptoms such as recurrent headaches; pain in the face and/or temple region; difficulties and pain in chewing; difficulties in opening the mouth wide and clickings.

Also included in the interview were questions concerning oral parafunctions namely grinding, clenching, lip-cheek-biting, nailbiting and thumbsucking.

Recurrent headaches were recorded when headaches appeared more than once a week.

The clinical examination comprised palpation of the temporomandibular joint (TMJ) and TMJ muscles; the presence of open and deep bite; occlusal interferences in retruded position (RP) (defined as unilateral or bilateral contacts with a vertical difference between RP and intercuspal position (IP)); and mediotrusion interferences (defined as contacts with shining facets on the mediotrusion side during any stage of lateral movement).

Statistics. The chi-square test was used to test the statistical significance or correlations between variables and differences between groups. The correlations to age was also tested by the Spearman rank correlation coefficient, R_s . The following levels of significance were used: N.S. (not significant) $p \geq 0.05$, $p < 0.05$, $p < 0.01$ and $p < 0.001$.

RESULTS

The prevalence of oral parafunctions, occlusal interferences, malocclusions and symptoms and signs of disturbances and diseases is shown in Table 2.

There was no statistically significant difference in symptoms found between boys and girls. The distribution by age is shown in Fig. 1. The symptoms showed a gradual, but statistically significant increase with age ($R_s = 0.07$, $p < 0.05$).

Recurrent headaches in boys and girls is shown in Fig. 2. There was no significant correlation between recurrent headaches and age, but headaches were significantly more common among girls than boys in the 7-14 age group ($p < 0.01$). The distributions of recurrent headaches and tenderness to palpa-

tion of the anterior temporal muscle and the masseter muscle by age are shown in Fig. 3. Tenderness of the anterior temporal and masseter muscle was significantly correlated to recurrent headaches ($p < 0.001$).

Reported clickings in boys and girls are shown in Fig. 4, and the prevalence was noted particularly high in the ages 10, 14 and 18 for girls; and 7, 8, 13 and 18 for boys. Clickings were positively and significantly, but weakly correlated to age ($R_s = 0.09$, $p < 0.01$).

The distribution by age of grinding and of clenching is shown in Fig. 5a and b. There was a significant negative correlation between both grinding and clenching with age ($R_s = -0.16$ and $R_s = -0.13$, respectively, $p < 0.001$). Boys in the age range 7-14 years reported clenching significantly more often than girls of the same age group ($p < 0.05$).

Lip-cheek-biting and nailbiting were frequently reported in all ages investigated. In the age group between 15-18 years, the girls reported lip-cheek-biting significantly more often than boys of the same age group ($p < 0.01$). Nailbiting on the other hand was reported significantly more often by boys in this age group ($p < 0.05$).

There was a statistically significant correlation between anterior open bite and thumbsucking ($p < 0.01$). Their distribution by age are shown in Fig. 6.

Tenderness to palpation of the TMJ as well as the TMJ muscles was significantly more common in the 7-10 year olds than in the 11-14 year olds ($p < 0.05$ and $p < 0.01$, respectively). Girls in the age group, 7-14 showed tenderness to palpation of the TMJ significantly more often than the boys of the same age group ($p < 0.05$).

Interferences between RP and IP were found significantly more often among girls than boys in the age 15-18 years ($p < 0.01$). Mediotrusion interferences were not significantly correlated to age, and were evenly distributed between the sexes.

The anterior open bite and deep bite decreased significantly with age as shown in Fig. 6 ($R_s = -0.18$, $p < 0.001$ and $R_s = -0.08$, $p < 0.05$).

DISCUSSION

This epidemiologic study comprised an interview and a clinical examination. The errors of the interview technique have been discussed earlier (Nilner & Lassing 1981). The methods of clinical examination in this investigation have long been used as standard procedures in departments of Stomatognathic Physiology. Different aspects of the technique have been evaluated (Ingervall 1971, Helkimo, Ingervall & Carlsson 1971, Carlsson & Helkimo 1972, Lindquist 1973, Carlsson, Helkimo & Agerberg 1974, Kopp 1977, Carlsson, Egermark-Eriksson & Magnusson 1980). The prevalence figures of tenderness to palpation of the TMJ and TMJ muscles in the younger age group of this study were higher than reported in other studies (Geering-Gaerny & Rakosi 1971, Grosfeld & Czarnecka 1977, Egermark-Eriksson et al. 1981). This difference is probably due to different palpation techniques and evaluation of the individual response to the palpation. Egermark-Eriksson et al. (1981) recorded pain on palpation when there was a difference between sides or when there was a palpebral reflex. In the present study pain on palpation was recorded when the children reported tenderness on one or both sides.

The distribution by age of the symptoms of functional disturbances and diseases in the stomatognathic system in the age groups investigated corroborates with those reported earlier, i.e. the frequency of symptoms generally increases slowly with age (Egermark-Eriksson et al. 1981). In this study the correlation was thus rather weak ($R_s = 0.07$). Symptoms in this study were confirmed 36% in the 7-14 age group and 41% in the 15-18 age group. These figures were somewhat higher than those reported by Egermark-Eriksson et al. (1981; 16%, 17% and 25% in the ages 7, 11 and 15). They have reported, however, very high prevalence figures when incorporating pain and tiredness in the face or jaw during chewing (39%, 67% and 74%). The prevalence figures in epidemiologic studies of this kind are thus heavily influenced by the definitions of the variables and the figures are not fully comparable if different definitions have been used.

Recurrent headaches were assessed by interview. One must thereby consider the possibility that some of the younger children have been too co-operative and therefore have responded with false affirmative answers. The higher prevalence of recurrent headaches in girls 7-14 years old as compared to boys of the same age group is difficult to explain. It may be related to differences in physical and mental maturation which exist between the sexes (Cole 1959). Recurrent headaches have also been reported to be more common among girls in two previous studies (Bille 1962, Egermark-Eriksson 1982). Both these investigators have reported a sex difference in the 15 year age group. The prevalence figures of headaches in this study of 7-18 year olds, were in accordance with those reported by Øster (1972) in the 6-17 age group (20.6%). He also found that girls were more frequently afflicted by headaches. Sillanpää (1976) has reported an overall presence of headaches of 37.7%; frequent headaches, occurring twice a month or more were found in 13.3% of the subjects and migraine was estimated at 3%. In Bille's (1962) series 58.7% of the individuals were found to have headaches of any periodicity and 3.9% of them were diagnosed to have migraine and 54.8% muscle contraction headaches. It is interesting to note the climax of prevalence of recurrent headaches at different ages, which have been found to be similar between the sexes. These peaks may correspond with troublesome maturation stages with a lot of mental stress (Rugh & Solberg 1979).

Based on the correlation found in this and previous studies (Nilner 1983a, Nilner 1983b) between recurrent headaches, tenderness in the anterior temporal and masseter muscles it appears that the headaches are at least partly of the muscular contraction type. This suggests that pain in the muscles are the main underlying cause of headaches. This opinion has also been stated by other investigators (Magnusson & Carlsson 1978, Lous & Olesen 1982) and is in agreement with the figures cited above for migraines. In this study the prevalence figures of tenderness to palpation of the TMJ muscles was high, especially among the younger children (7-10 years). The muscle and TMJ tenderness was assessed by the subjective response of the

children to palpation. This could be one explanation to the difference between the age groups i.e. the younger children may have experienced the procedure to have been more painful.

There was a gradual increase with age of clickings. Clickings were more common in girls than in boys at 10, 14 and 18 years of age. The frequency distribution by age, of the age group studied, appeared noteworthy. The explanation for this difference may be found in the occlusion, as correlations have been noted between interferences in RP and clickings (Egermark-Eriksson, Ingervall & Carlsson 1982, Nilner 1983a, Nilner 1983 b). Interferences between RP and IP were also found to be more frequent in 15-18 year old girls in this study.

The prevalence of grinding reported in this study is in accordance with those reported for 7- (16%), 11- (8%), and 15- (10%)-year olds (Egermark-Eriksson et al. 1981) Holm and Andersson (1974) and Holm (1975a, 1975b, 1978) have reported figures of 24, 28, 32 and 21% among 3-, 4-, 5- and 8 year old children. In the later study (Holm 1978) the parents reported that 21% of the 8-year old children ground their teeth at night. Seven per cent of these had done so since the age of 3. This is interesting since 7% was the figure of prevalence of grinding among the 15-18 year olds in the study by Nilner (1981). There appears to be maximum frequency of grinding around 7-10 years of age. The high prevalence of grinding and clenching in the 7-10 years old children may be partly explained by the erupting permanent teeth causing interferences of occlusion. The presence of grinding and clenching in boys at 13 years of age was markedly higher than that in girls of the same age. The underlying reason is unknown, but the frequent appearance of grinding and clenching among boys around 13 years of age, and among girls around 10 years of age, corresponds with the pubertal growth spurt peak in boys, and the start of the spurt in girls (Taranger & Hägg 1980).

Oral parafunctions such as lip-cheek-biting and nailbiting were frequently reported. In contrast to grinding and clenching they had an even distribution by age. The most probable explanation for this is that grinding and clenching are oral parafunctions which are associated with the development of occlu-

sion. While nailbiting and lip-cheek-biting are parafunctions, which are more evenly distributed in childhood and adolescence (Egermark-Eriksson et al. 1981).

The correlation found between thumbsucking and anterior open bite indicates that thumbsucking is a cause to anterior open bite between 7 and 13 years of age (Larsson 1972). After 13 years of age other factors, such as tongue-thrusting, which is not in the scope of this study, may be responsible.

The prevalence of mediotrusion interferences was high in these age groups (Nilner & Lassing 1981, Nilner 1981) compared to others (Ingervall 1972, Mohlin & Kopp 1978, Carlsson 1978, Egermark-Eriksson et al. 1981). The most probable reason for this is that different definitions of mediotrusion interferences have been used. The frequency distribution of mediotrusion interferences showed three peaks in this study, at approximately 8, 14 and 18 years of age. This was probably due to dysocclusion of the first, second and third molars. These teeth, especially tipped or in cross-bite position, have been shown to be a cause of mediotrusion interferences (Mohlin & Kopp 1978).

The frequency distribution by age of deep bite in this study showed a maximum of approximately 10 years of age, about the time when the deciduous teeth are exfoliating, and before the permanent occlusion has been established. The frequency of deep bite decreased sharply after 11 years of age, when occlusion has started to settle.

To summarize, recurrent headaches showed a characteristic frequency distribution by age, which corresponded well with that of palpatory tenderness of the anterior temporal and masseter muscles. The prevalence of symptoms including clickings increased gradually with age. Parafunctions like grinding and clenching had a different distribution i.e. decreased with age. Lip-cheek-biting and nailbiting were evenly distributed with age.

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Table 1. Distribution of the 749 examined children and adolescents according to age and sex.

Age Sex	7	8	9	10	11	12	13	14	15	16	17	18
♂	39	28	24	23	24	26	31	27	51	37	35	24
♀	31	24	23	24	35	21	31	29	41	48	40	33
Σ	70	52	47	47	59	47	62	56	92	85	75	57

Table 2. Prevalence in per cent of symptoms, signs, oral parafunctions, malocclusions and occlusal interferences of the stomatognathic system in 7-18 year olds (n = 749).

Symptoms and signs												
At least one symptom present	37	27	30	55	32	23	42	39	38	33	45	53
Recurrent headaches	17	10	11	21	14	13	19	9	15	12	24	11
Clickings (reported)	16	10	9	15	12	4	18	20	13	12	20	30
Tenderness to palpation of:												
TMJ-muscles (at least one muscle)	71	67	66	70	53	49	71	59	67	58	47	40
anterior temporal muscle	37	29	32	26	22	13	31	16	24	11	17	12
the attachment of the ant temp muscle	39	31	38	36	24	20	40	25	26	21	19	12
masseter muscle	36	29	36	47	19	15	23	11	20	13	17	19
TMJ	43	54	43	47	31	28	40	25	25	39	26	43
Oral parafunctions												
Grinding	23	23	23	17	7	9	19	7	4	7	9	7
Clenching	29	25	26	28	25	11	13	5	10	13	13	19
Lip-cheek-biting	41	42	43	51	49	47	48	34	45	48	52	40
Nailbiting	39	54	53	57	56	51	48	43	42	49	44	46
Thumbsucking	17	2	6	6	3	2	-	-	-	-	-	-
Malocclusions and occlusal interferences												
Deep bite	21	27	32	34	37	26	26	18	23	17	23	19
Open bite	21	8	32	28	9	13	5	9	9	6	7	4
RP-interferences	70	81	83	83	76	83	88	73	75	86	81	93
unilateral	51	67	68	68	70	79	68	61	66	75	71	79
Mediotrusion interferences	81	89	64	64	73	75	81	82	75	73	79	81

FIGURE LEGENDS

- Fig. 1. Distribution in per cent by age of symptoms of functional disturbances and diseases in the stomatognathic system including recurrent headaches, pain in the face and/or temple region, difficulties and pain in chewing, difficulties in opening the mouth wide and clickings.
- Fig. 2. Distribution in per cent by age and sex of recurrent headaches.
- Fig. 3. Distribution in per cent by age of recurrent headaches, tenderness to palpation of anterior temporal and masseter muscle.
- Fig. 4. Distribution in per cent by age and sex of reported clickings.
- Fig. 5a. Distribution in per cent by age of grinding.
5b. Distribution in per cent by age of clenching.
- Fig. 6. Distribution in per cent by age of thumbsucking, open and deep bite.

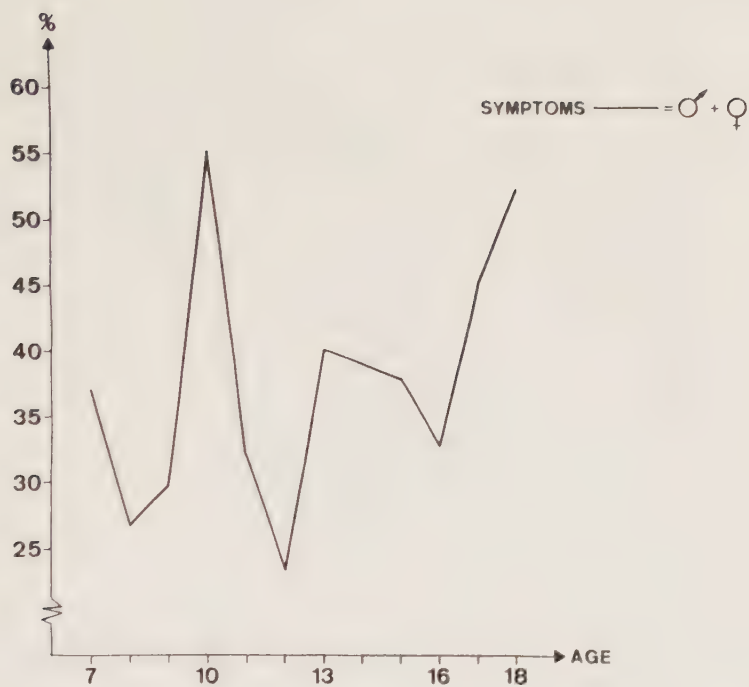


Fig. 1.

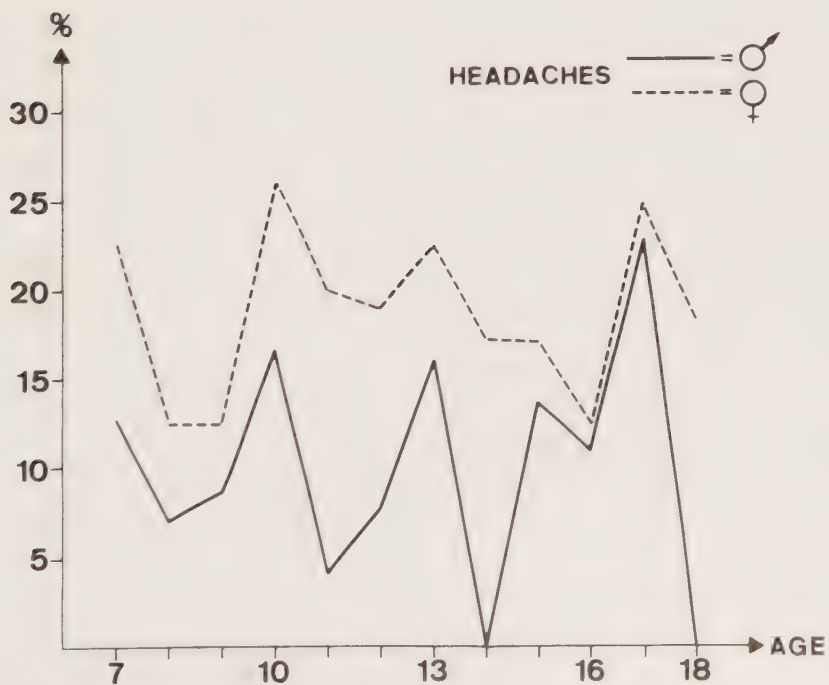


Fig. 2.

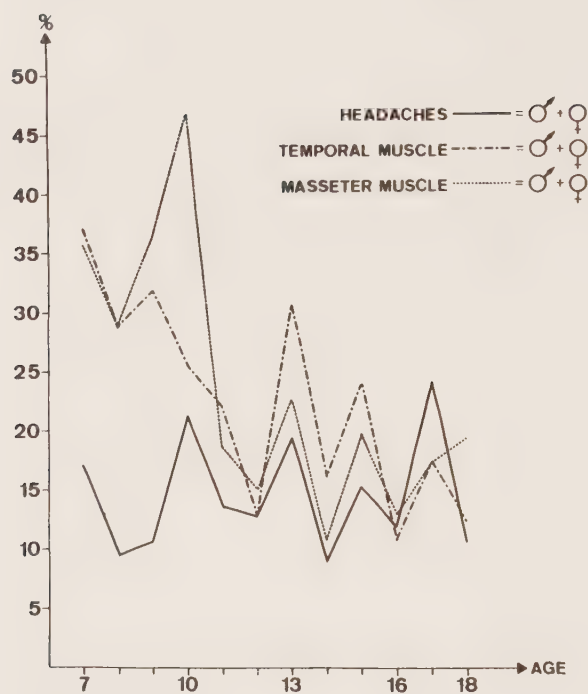


Fig. 3.

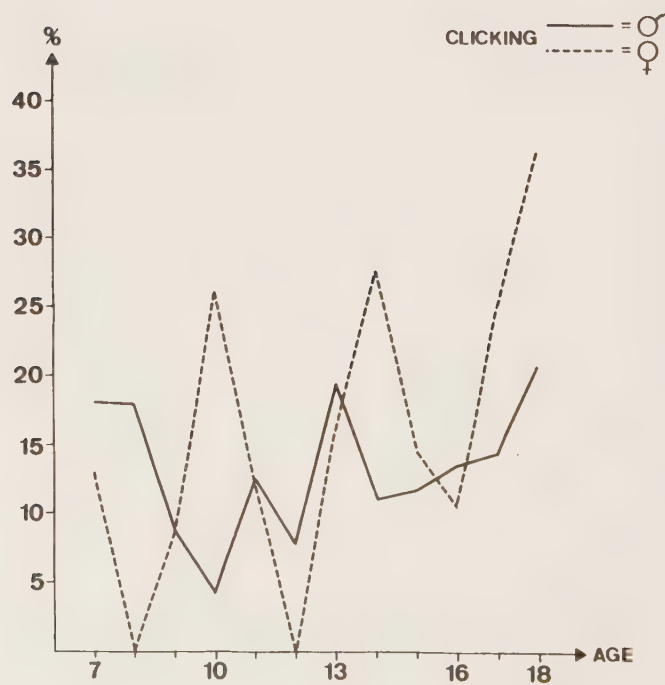


Fig. 4.

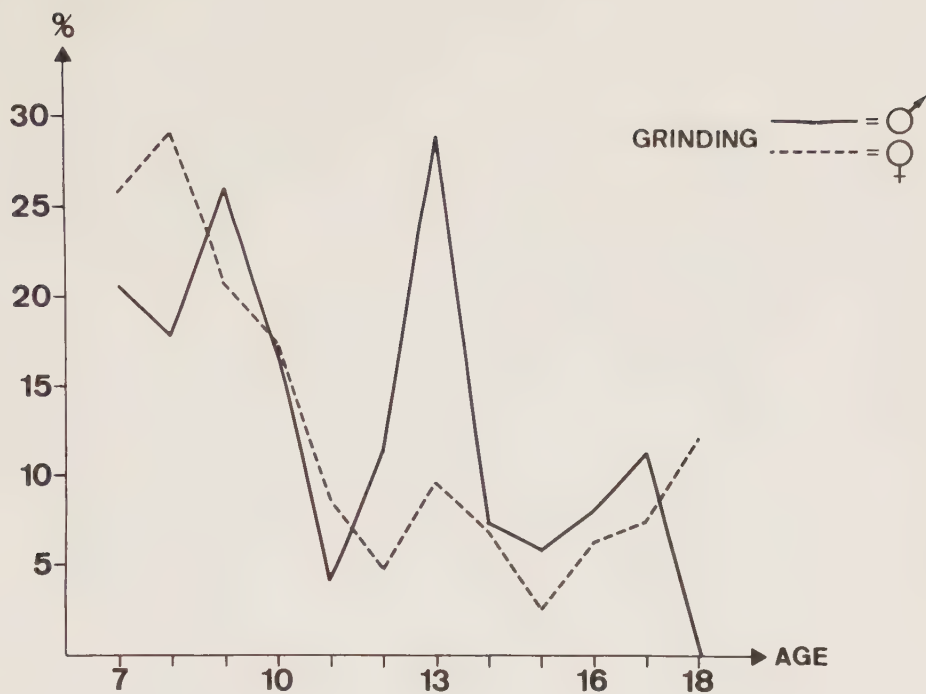


Fig. 5a.

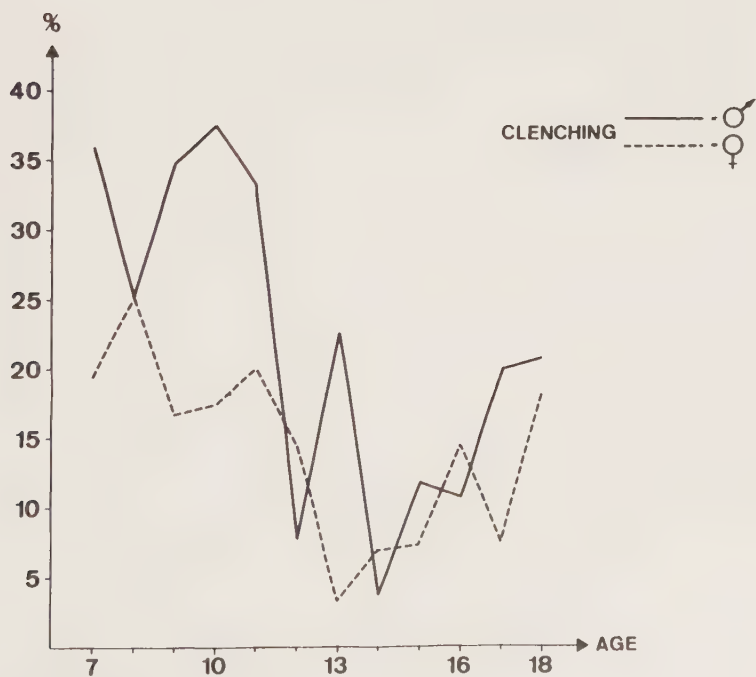


Fig. 5b.

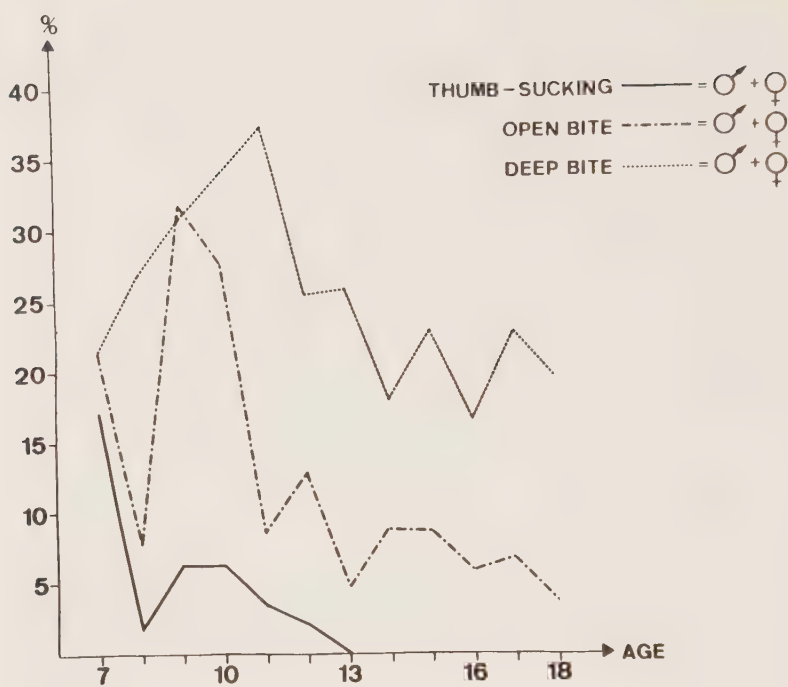


Fig. 6.

